INDEPENDENT ORBITER ASSESSMENT

ASSESSMENT
OF THE
GUIDANCE, NAVIGATION,
AND CONTROL SUBSYSTEM

23 JANUARY 1988

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MCDONNELL DOUGLAS ASTRONAUTICS COMPANY HOUSTON DIVISION

SPACE TRANSPORTATION SYSTEM ENGINEERING AND OPERATIONS SUPPORT

WORKING PAPER NO. 1.0-WP-VA88003-06

INDEPENDENT ORBITER ASSESSMENT
ASSESSMENT OF THE GUIDANCE, NAVIGATION, AND CONTROL SUBSYSTEM
FMEA/CIL

23 JANUARY 1988

This Working Paper is Submitted to NASA under Task Order No. VA88003, Contract NAS 9-17650

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Independent Orbiter Assessment Assessment of the Guidance, Navigation, and Control System FMEA/CIL

1.0 EXECUTIVE SUMMARY

The McDonnell Douglas Astronautics Company (MDAC) was selected in June 1986 to perform an Independent Orbiter Assessment (IOA) of the Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL). Direction was given by the STS Orbiter and GFE Projects Office to perform the hardware analysis using the instructions and ground rules defined in NSTS 22206, Instructions for Preparation of FMEA and CIL, 10 October 1986.

The IOA effort first completed an analysis of the Guidance, Navigation, and Control System (GNC) hardware, generating draft failure modes and potential critical items. To preserve independence, this analysis was accomplished without reliance upon the results contained within the NASA FMEA/CIL documentation. The IOA results were then compared to the NASA FMEA/CIL baseline with proposed Post 51-L updates included. A resolution of each discrepancy from the comparison is provided through additional analysis as required. This report documents the results of that comparison for the Orbiter GNC hardware.

The IOA product for the GNC analysis consisted of one-hundred forty-one (141) failure mode "worksheets" that resulted in twenty-four (24) potential critical items being identified. Comparison was made to the NASA baseline (as of 4 January 1988) which consisted of one-hundred forty-eight (148) FMEAs and thirty-six (36) CIL items. The comparison determined if there were any results which had been found by the IOA but were not in the NASA baseline. This comparison produced agreement on all but fifty-six (56) FMEAs which caused differences in zero (0) CIL items. Reference Figure 1.

The issues arose due to <u>different Interpretation of NSTS 22206</u>, <u>FMEA/CIL preparation instructions</u>. IOA analyzed the components of the electrical circuits, generating fifty-six (56) worksheets more than NASA, who treated the electrical circuits as black boxes. Of these fifty-six (56) differences with the FMEA's, all were minor and did not affect criticalities assessments. In conclusion, IOA is in full agreement with the revised NASA CIL baseline.

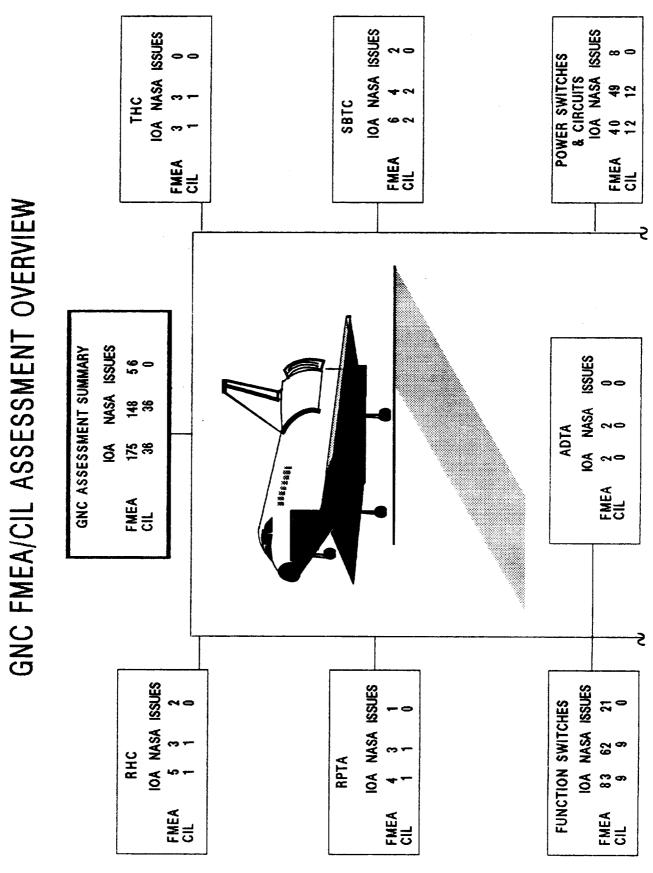
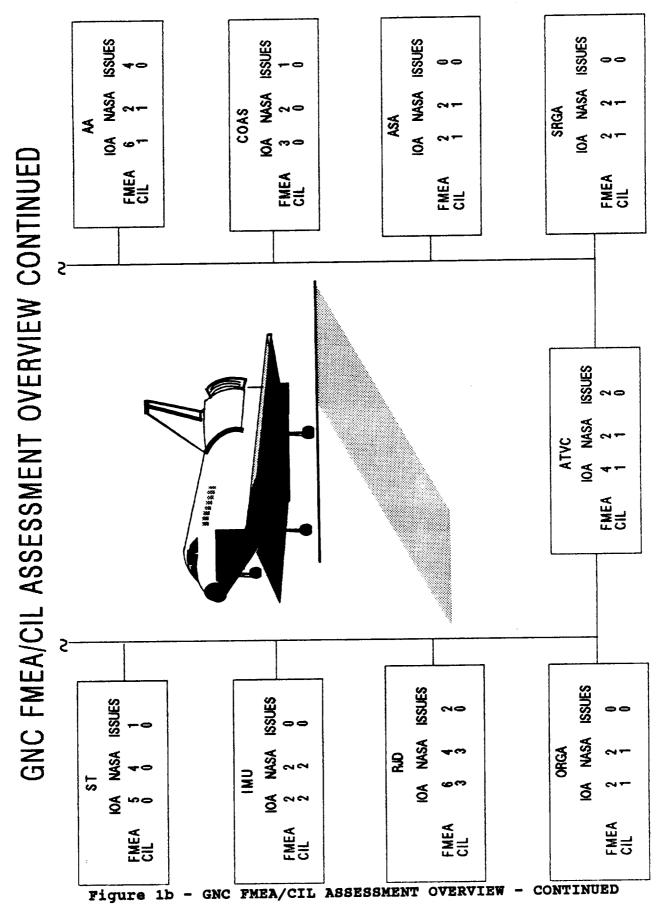


Figure 1a - GNC FMEA/CIL ASSESSMENT OVERVIEW



2.0 INTRODUCTION

2.1 Purpose

The 51-L Challenger accident prompted the NASA to readdress safety policies, concepts, and rationale being used in the National Space Transportation System (NSTS). The NSTS Office has undertaken the task of reevaluating the FMEA/CIL for the Space Shuttle design. The MDAC is providing an independent assessment of the proposed Post 51-L Orbiter FMEA/CIL for completeness and technical accuracy.

2.2 Scope

The scope of the independent FMEA/CIL assessment activity encompasses those Shuttle Orbiter subsystems and GFE hardware identified in the Space Shuttle Independent FMEA/CIL Assessment Contractor Statement of Work. Each subsystem analysis addresses hardware, functions, internal and external interfaces, and operational requirements for all mission phases.

2.3 Analysis Approach

The independent analysis approach is a top-down analysis utilizing as-built drawings to breakdown the respective subsystem into components and low-level hardware items. Each hardware item is evaluated for failure mode, effects, and criticality. These data are documented in the respective subsystem analysis report, and are used to assess the proposed Post 51-L NASA and Prime Contractor FMEA/CIL. The IOA analysis approach is summarized in the following Steps 1.0 through 3.0. Step 4.0 summarizes the assessment of the NASA and Prime Contractor FMEA/CIL which is documented in this report.

- Step 1.0 Subsystem Familiarization
 - 1.1 Define subsystem functions
 - 1.2 Define subsystem components
 - 1.3 Define subsystem specific ground rules and assumptions
- Step 2.0 Define subsystem analysis diagram
 - 2.1 Define subsystem
 - 2.2 Define major assemblies
 - 2.3 Develop detailed subsystem representations
- Step 3.0 Failure events definition
 - 3.1 Construct matrix of failure modes
 - 3.2 Document IOA analysis results

Step 4.0 Compare IOA analysis data to NASA FMEA/CIL

- 4.1 Resolve differences
- 4.2 Review in-house
- 4.3 Document assessment issues
- 4.4 Forward findings to Project Manager

2.4 Ground Rules and Assumptions

The GNC ground rules and assumptions used in the IOA are defined in Appendix B.

3.0 SUBSYSTEM DESCRIPTION

3.1 Design and Function

The function of the GNC hardware is to respond to guidance, navigation, and control software commands to effect vehicle control and to provide sensor and controller data to GNC software.

The functions of the GNC software can be divided into flight control, guidance, navigation, hardware data processing, and crew display. The specific tasks of each function, as well as the GNC hardware used to support them, vary with mission phase.

Figure 2 is an overview of the GNC hardware for which failure modes analysis was performed. For the analysis, the hardware was divided into the following three categories:

I. MAJOR COMPONENTS (BLACK BOXES) - This category includes the sensors, manual controllers, and effector interfaces listed below:

RHC	(8)	ADTA	
THC	(9)	RGA	(ORB)
RPTA	(10)	RGA	(SRB)
SBTC	(11)	AA	•
IMU	(12)	ASA	
ST	(13)	RJD	
COAS	(14)	ATVC	
	RHC THC RPTA SBTC IMU ST COAS	THC (9) RPTA (10) SBTC (11) IMU (12) ST (13)	THC (9) RGA RPTA (10) RGA SBTC (11) AA IMU (12) ASA ST (13) RJD

Figures 3 - 16 provide a hardware breakdown of each of the above components.

FUNCTION SWITCHES AND CIRCUITS - This category consists of switches/circuits whose primary purpose is to select a particular mode of operation for the GNC software. Twelve groups were identified and are listed below:

(1)	TRIM ENABLE INHIBIT SW'S	(8)	ATT REF PBI
(2)	TRIM SW'S	(9)	ENTRY MODE SW CKT
(3)	TRIM ON/OFF SW'S	(10)	ABORT MODE CKT
(4)	SENSE -Z/-X SW	(11)	DAP PBI'S
(5)	P,R/Y CSS/AUTO PBI'S	(12)	FCS CHNL CNTL CKT
(6)	SPD BK/THROT PBI'S	•	

(7) BODY FLAP CNTL CKT

III. POWER SWITCHES AND CIRCUITS - This category consists of groups of switches/circuits that provide electrical power to the major components and Flight Control System (FCS) annunciation lamps. Thirteen groups were identified and are listed below:

(1)	FLT CNTLR PWR CKT	(8)	RGA (SRB) PWR CKT
(2)	IMU PWR CKT	(9)	AA PWR CKT
	ST PWR CKT	(10)	ASA PWR CKT
(4)	ST DOOR PWR CKT	(11)	RJD PWR CKT
	COAS PWR CKT	(12)	ATVC PWR CKT
• •	ADTA PWR CKT	(13)	FCS SW ANNUN CKT
	RGA (ORB) PWR CKT		

A brief description of the major components and function switches and circuits is provided below.

- 1. Three RHC's, two forward and one aft, provide manual attitude control.
- Two THC's, one at the CDR's station and one aft, provide manual translation control with the use of the RCS system.
- 3. Two RPTA's, one connected to the CDR's pedals and one to the PLT's, send rudder and nose wheel steering commands to the GPCs.
- 4. Two SBTCs, one at the CDRs station and one at the PLTs, control the speedbrake during entry. The pilot's SBTC can also be used for main engine throttle control during ascent.
- 5. Three IMU's, attached to the NAV base, provide acceleration and attitude data to the GPC's.
- 6. Two ST's, mounted on the NAV base, are used to align the IMU's and to provide line of site vectors during rendezvous missions.
- 7. One COAS that can be mounted at the CDR's station or the aft station is a backup to the ST's for use in IMU alignment.
- 8. Four ADTA's, located in the forward avionics bay, provides pressure data to the GPC's. this data is used during entry to calculate angle of attack, relative speed, mach number, and barometric altitude.
- 9. Four orbiter RGA's, mounted at the bottom of the aft bulkhead, provide attitude rates about each body axis to flight control for stability augmentation during ascent and entry. The RGA's also drive the rate needles of the ADI's during ascent.

- 10. Four SRB RGA's, two on the left and two on the right SRB, provide pitch and yaw rates to flight control to assist in SRB TVC and to provide stability augmentation during ascent until SRB separation.
- 11. Four AA's, located in the forward avionics bays, measure normal and lateral body acceleration for use in flight control to provide stability augmentation during ascent and entry.
- 12. Four ASA's, located in the aft avionics bays, derive aerosurface actuator position error commands and perform fault detection.
- 13. Four RJD's, two forward and two aft, in response to flight control commands, send signals to open/close the oxidizer and fuel valves associated with each RCS jet.
- 14. Four ATVC's, located in the aft avionics bays, provide SRB and main engine gimbal control for slewing engine bells prior to liftoff, gimbaling engines to control trajectory during flight, positioning the main engines to a dump position, and stow position.
- 15. Two TRIM ENABLE/INHIBIT switches, CDR's and PLT's, allow the software to accept or reject trim commands from the panel trim switches and the RHC trim switches.
- 16. Six TRIM switches, a roll, pitch, yaw set at the CDR's and PLT's station, allow the crew to make small changes in the vehicles attitude via commands to the aerosurfaces.
- 17. Two panel TRIM ON/OFF switches, CDR's and PLT's, provide power to the associated TRIM switches when in the "ON" position.
- 18. One SENSE -Z/-X switch located on the aft panel A6, is used onorbit to make the aft RHC, THC, and ADI correspond to the operator's line of sight.
- 19. Two sets of PITCH, ROLL/YAW CSS/AUTO PBI's exist (eight switches total) that allow the CDR or PLT to select auto or manual (CSS) attitude control during ascent and entry.
- 20. Two SPD BK/THROT PBI's, CDR's and PLT's station, allow the crew to switch to auto from manual throttle control during ascent and to auto or manual speed brake control during entry.
- 21. The BODY FLAP CONTROL CIRCUIT consists of two BODY FLAP UP/DOWN switches and two BODY FLAP AUTO/MANUAL PBI's that allow manual or auto control from either the CDR's or PLT's station.

- 22. Three ATT REF PBI's, located at the CDR's, PLT's, and aft crew stations, allow the crew to select a reference frame from which attitude errors will be displayed on the three Attitude Direction Indicators (ADI). The ATT REF PBI is also used to take "marks" when the COAS is used for IMU alignment.
- 23. The ENTRY MODE SWITCH CIRCUIT provides capability for the crew to change DAP control modes during entry via the ENTRY MODE switch.
- 24. The ABORT MODE SWITCH CIRCUIT provides capability for the crew to select and initiate an abort mode during ascent via the ABORT MODE ROTARY switch and the ABORT push button.
- 25. Forty eight DAP PBI's (24 fwd and 24 aft) provide crew flexibility in selecting translational and rotational control options with the ONORBIT and TRANS DAPS.
- 26. Four FCS CHANNEL CONTROL CIRCUITS provide power and control to one of four ASA's and ATVC's via the four FCS CHANNEL OVERRIDE/AUTO/OFF switches on panel C3.

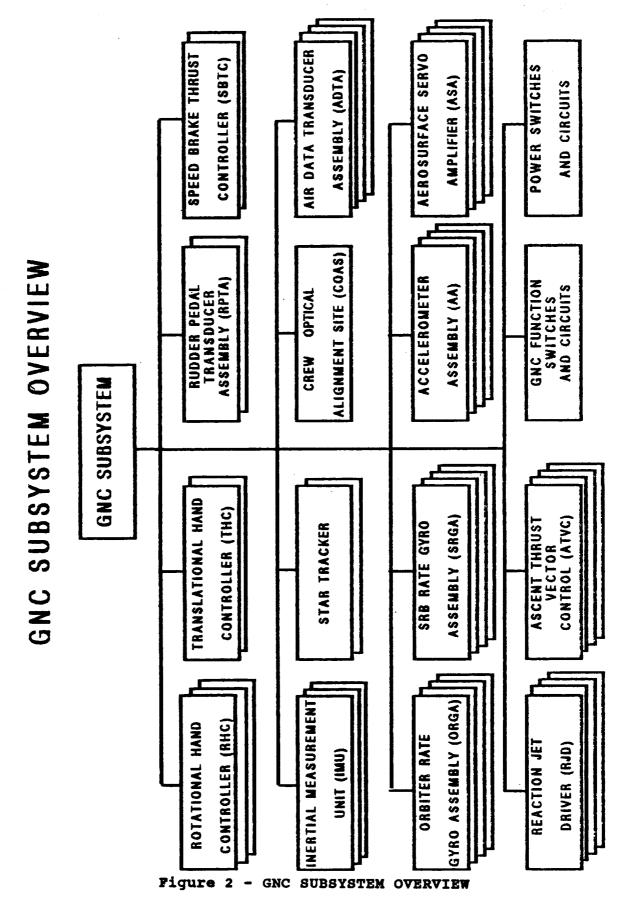
3.2 Interfaces and Locations

The GNC hardware is located throughout the orbiter. The precise location for each component/switch/circuit was provided on the analysis worksheets in Working Paper No. 1.0-WP-VA86001-16.

The GNC hardware is interfaced with the software via the flight critical MDM's. Switch and power status is monitored via the flight critical MDM's and operational instrumentation.

3.3 Hierarchy

Figure 2 illustrates the breakdown of the GNC into it's hardware components, and Figures 3 through 16 are the detailed systems representations.



CMD - C CMD - B CDR BFS ENGAGE SWITCH BFS MODE CMD - A GNC ROTATIONAL HAND CONTROLLER COMM RHC-RI ROTATIONAL HAND CONTROLLER RHC - LFT (CDR) PLT SWITCH TRIM CDR TRIM CMD - C YAW TRANSDUCER CMD -- A PITCH COMMAND TRANSDUCER ROLL AXIS YAW PITCH MECHANICAL STICK MOVEMENT ROLL AXIS

Figure 3 - GNC ROTATIONAL HAND CONTROLLER (RHC)

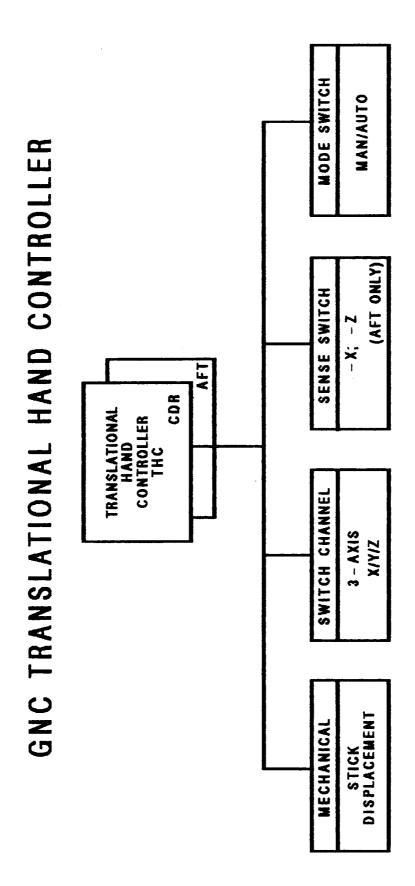


Figure 4 - GNC TRANSLATIONAL HAND CONTROLLER (THC)

GNC RUDDER PEDAL TRANSDUCER ASSEMBLY

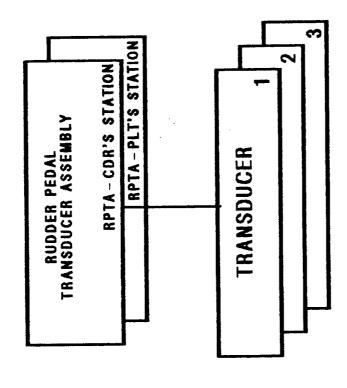


Figure 5 - GNC RUDDER PEDAL TRANSDUCER ASSEMBLY (RPTA)

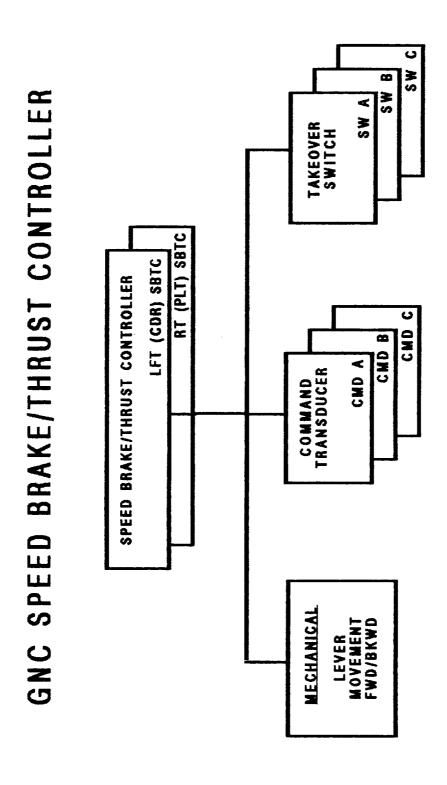


Figure 6 - GNC SPEED BRAKE THRUST CONTROLLER (SBTC)

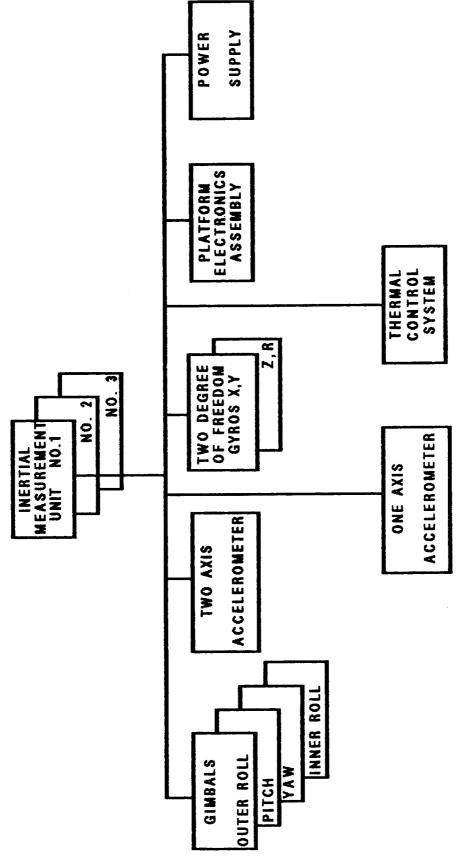


Figure 7 - GNC INERTIAL MEASUREMENT UNIT (IMU)

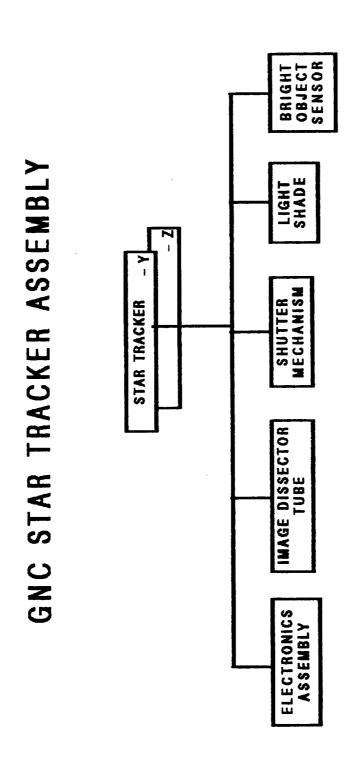


Figure 8 - GNC STAR TRACKER (ST)

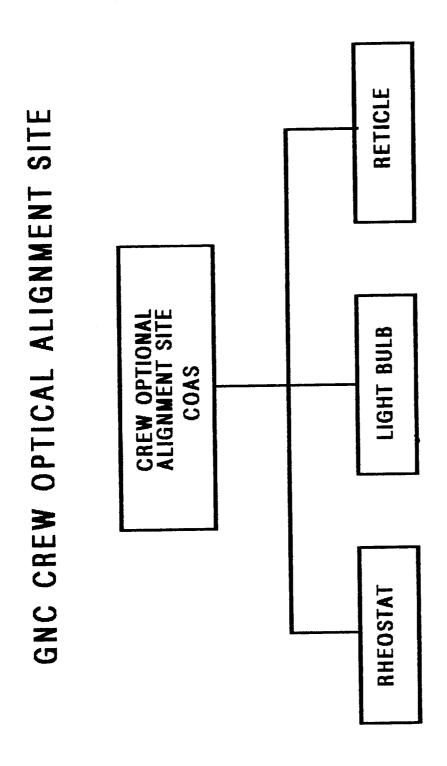


Figure 9 - GNC CREW OPTICAL ALIGNMENT SITE (COAS)

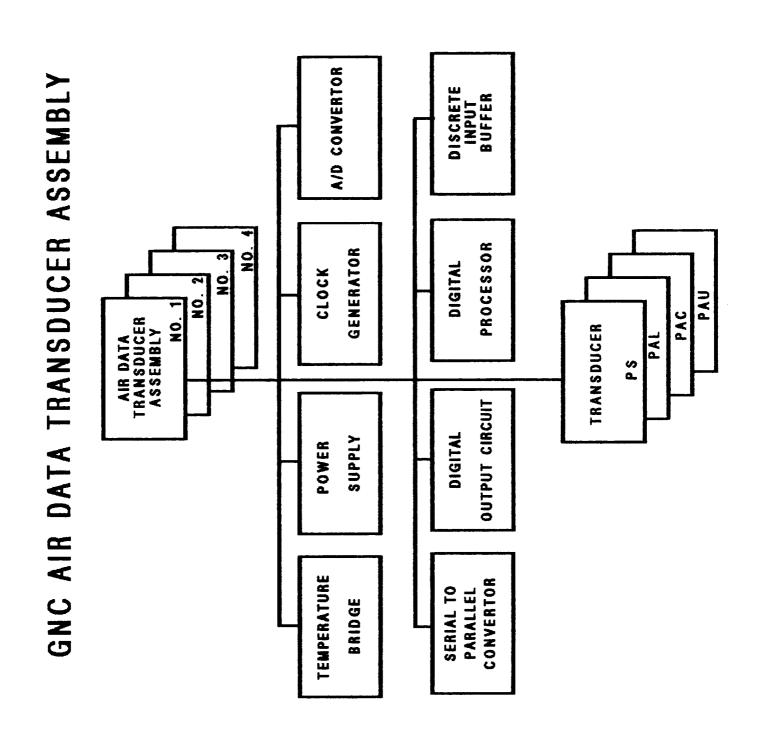


Figure 10 - GNC AIR DATA TRANSDUCER ASSEMBLY (ADTA)

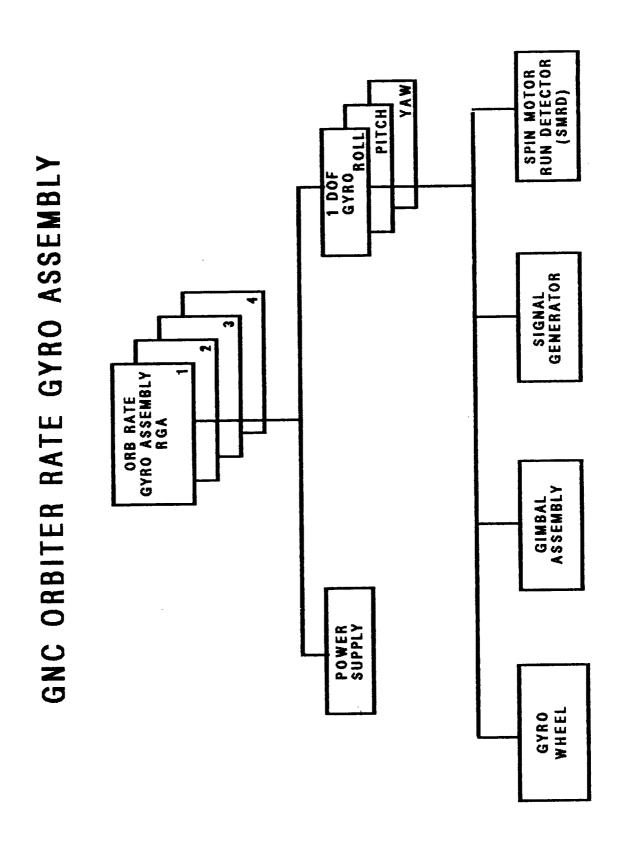


Figure 11 - GNC ORBITER RATE GYRO ASSEMBLY (ORGA)

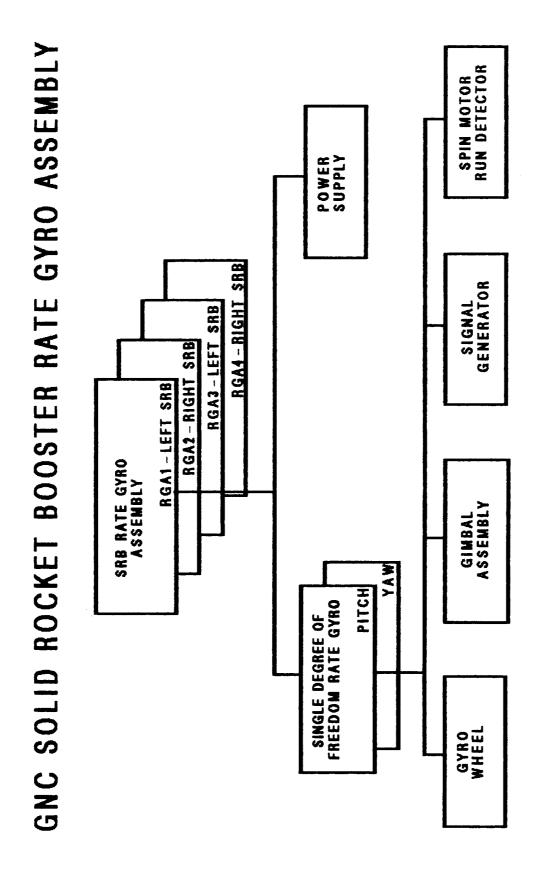


Figure 12 - GNC SRB RATE GYRO ASSEMBLY (SRGA)

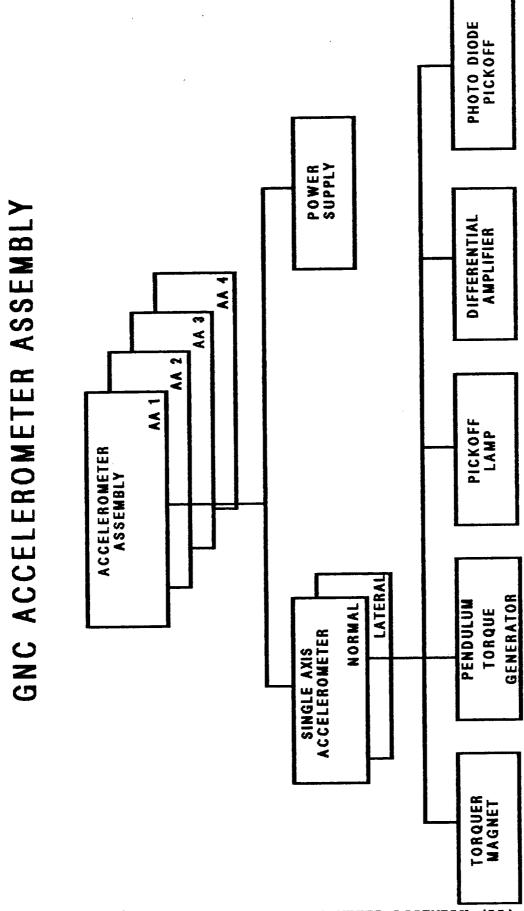
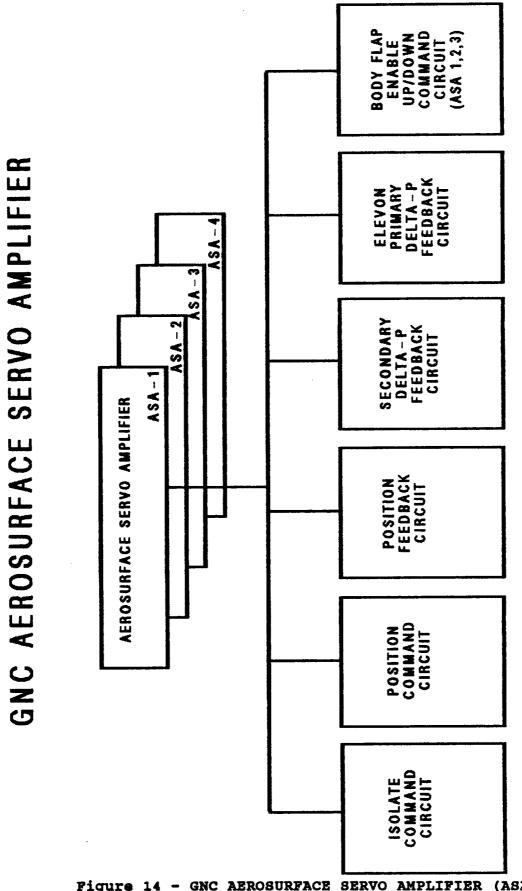


Figure 13 - GNC ACCELEROMETER ASSEMBLY (AA)



14 - GNC AEROSURFACE SERVO AMPLIFIER (ASA)

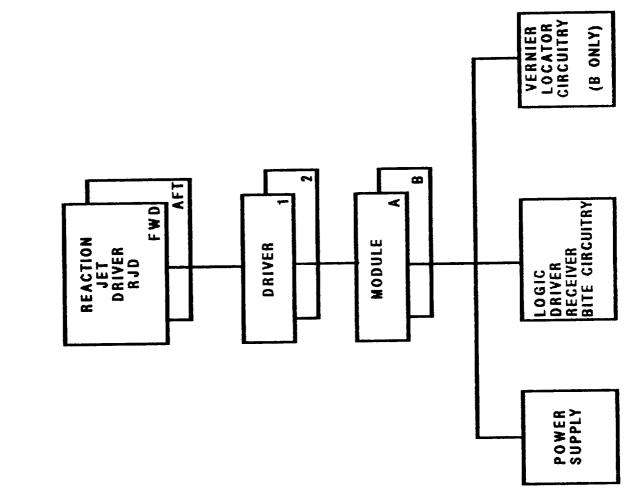


Figure 15 - GNC REACTION JET DRIVER (RJD)

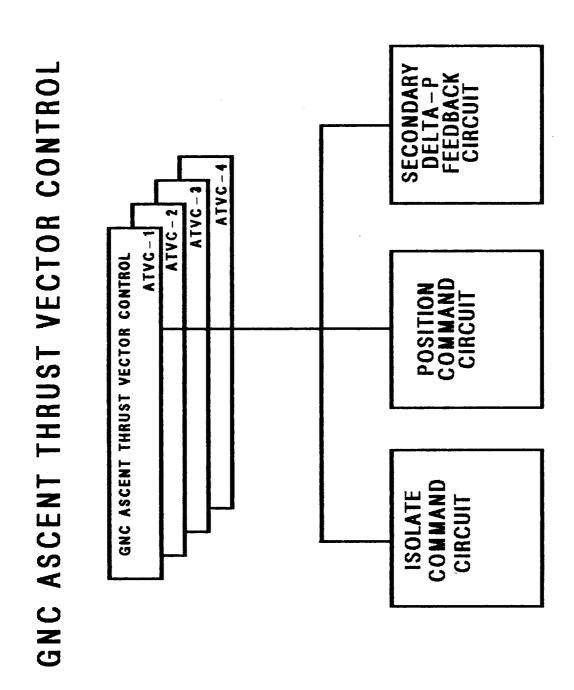


Figure 16 - GNC ASCENT THRUST VECTOR CONTROL (ATVC)

4.0 ASSESSMENT RESULTS

The IOA analysis of the GNC hardware initially generated one-hundred forty-one (141) failure mode worksheets and identified twenty-four (24) Potential Critical Items (PCIs) before starting the assessment process. In order to facilitate comparison, thirty-four (34) additional failure mode analysis worksheets were generated. These analysis results were compared to the proposed NASA Post 51-L baseline of one-hundred forty-eight (148) FMEAs and thirty-six (36) CIL items, which were generated using the NSTS-22206 FMEA/CIL instructions. Upon completion of the assessment, one-hundred forty-three (143) of the one-hundred forty-eight (148) FMEAs were in agreement. Of the five (5) that remained, two (2) had minor discrepancies that did not affect criticality. Of the remaining three (3), the issues were with FMEAs 05-1-SRB-2, 05-60-6N0804-1, 2. In summary, no drawings were available to assess the above EPD&C FMEAs.

The GNC assessment was divided into the following three categories:

- I. MAJOR COMPONENTS (BLACK BOXES)
- II. FUNCTION SWITCHES AND CIRCUITS primary purpose is to select a particular mode of operation for the GNC software.
- III. POWER SWITCHES AND CIRCUITS these provide electrical power to the GNC major components and DAP annunciation lamps.

A summary of the quantity of NASA FMEAs assessed, versus the recommended IOA baseline, and any issues identified is presented in Table I.

Table I St	ımmary of I	OA FMEA As	sessment
Component	NASA	IOA	Issues
ALL	148	175	56

A summary of the quantity of NASA CIL items assessed, versus the recommended IOA baseline, and any issues identified is presented in Table II.

Table II Summary of IOA CIL Assessment								
Component	NASA	IOA	Issues					
ALL	36	36	0					

Table III presents a summary of the IOA recommended failure criticalities for the GNC subsystem for the Post 51-L FMEA baseline.

Table III	Sum	mary of	f IOA R	ecomme	nded Fa	ilure C	ritica	 lities
Criticalit	:y:	1/1	2/1R	2/2	3/1R	3/2R	3/3	TOTAL
Number	:	8	16	11	86	22	32	175

Table IV presents a summary of the IOA recommended CIL items for the GNC subsystem for the Post 51-L baseline.

Table IV	Summary	of IO	A Recor	mmended	Critica	al Ite	ns
Criticality:	1/1	2/1R	2/2	3/1R	3/2R	3/3	TOTAL
Number :	8	16	11	2	0	0	36

Appendix C presents the detailed assessment worksheets for each failure mode identified and assessed.

Appendix D highlights the NASA Critical Items and corresponding IOA worksheet ID.

Appendix E contains new IOA analysis worksheets that cover failure modes that were not included in the original analysis. These worksheets were added in order to make a comparison with the NASA FMEAs on these failure modes.

Appendix F provides a cross reference between the NASA FMEA and corresponding IOA worksheet(s). IOA recommendations are also summarized.

The scheme for assigning IOA assessment (Appendix C) and analysis (Appendix E) worksheet numbers is shown in Table V.

	Table V IOA Work	sheet Numbers
Co	mponent	IOA ID Number
1.	RHC	GNC-101 to 105
2.	FLT CNTLR PWR CKT	GNC-110 to 111
3.	TRIM ENABLE INHIBIT SW'S	GNC-120 to 121
4.	TRIM SW'S	GNC-130 to 131
5.	TRIM ON/OFF SW'S	GNC-140 to 141
6.	SENSE -Z/-X SW	GNC-150 to 151
7.	P,R/Y CSS/AUTO PBI'S	GNC-160 to 161
8.	THC	GNC-201 to 203
9.	RPTA	GNC-301 to 304
10	SBTC	GNC-401 to 406
11	SPD BK/THROT PBI	GNC-410 to 411
12	IMU	GNC-501 to 502
13	IMU PWR CKT	GNC-510 to 512
14	ST	GNC-601 to 604
15	ST PWR CKT	GNC-610 to 612
	COAS	GNC-701 to 703
	COAS PWR CKT	GNC-710 to 712
	ADTA	GNC-801 to 802
	ADTA PWR CKT	GNC-810 to 812
	RGA (ORB)	GNC-901 to 902
	RGA (ORB) PWR CKT	GNC-903 to 905
	RGA (SRB)	GNC-950 to 951
23.	•	GNC-960 to 961
24.	AA	GNC-1001 to 1002
	AA PWR CKT	GNC-1010 to 1014
26.	ASA	GNC-1101 to 1108
	FCS CHNL CNTL CKT	GNC-1110 to 1112
28.	ASA PWR CKT	GNC-1130 to 1131
29.	RJD	GNC-1201 to 1208
	RJD PWR CKT	GNC-1211 to 1214
	ATVC	GNC-1301 to 1305
	ATVC PWR CKT	GNC-1310 to 1311
	BODY FLAP CNTL CKT	GNC-1400 to 1404
34.	DAP PBI'S	GNC-1501 to 1586
35.	FCS SW ANNUN CKT	GNC-1590 to 1593
36.	ENTRY MODE SW	GNC-1601 to 1602
37.	ABORT MODE CKT	GNC-1801 to 1804
	ATT REF PB	GNC-1901 to 1902
	MEASUREMENT ISO RESISTORS	GNC-1950

The three GNC categories are discussed in the following sections along with issues, and the IOA recommendation for the Post 51-L FMEA/CIL.

4.1 ASSESSMENT RESULTS - GNC MAJOR COMPONENTS

Fourteen components were included in this category. A summary of the quantity of NASA FMEAs assessed for the GNC major components, versus the recommended baseline, and any issues identified is presented in Table VI.

Table VI GNC Major Components Summary of IOA FMEA Assessment								
Component	NASA	IOA	Issues					
1. RHC 2. THC 3. RPTA 4. SBTC 5. IMU 6. ST 7. COAS 8. ADTA 9. RGA (ORB) 10. RGA (SRB) 11. AA 12. ASA 13. RJD	3 3 4 2 4 2 2 2 2 2 2	5 3 4 6 2 5 3 2 2 2 6 2 6	2 0 1 2 0 1 1 0 0 0 4 0 2					
TOTAL	2 37	52	2 15					

The issues resulted from IOA analyzing failure modes not covered by NASA. These failures did not raise the criticality of the component. NASA should consider generating FMEA's for completeness. A summary of the quantity of NASA CIL items assessed for the GNC major components, versus the recommended IOA baseline, and any issues identified is presented in Table VII.

+			-		
Table VII	GNC Major Components Summary of IOA CIL Assessment				
Component	NASA	IOA	Issues		
1. RHC 2. THC 3. RPTA 4. SBTC 5. IMU 6. ST 7. COAS 8. ADTA 9. RGA (ORB) 10. RGA (SRB) 11. AA 12. ASA 13. RJD 14. ATVC	1 1 2 2 0 0 1 1 1 1 1 3	1 1 2 2 0 0 0 1 1 1 1 1 3	0 0 0 0 0 0 0 0		
TOTAL	15	15	0		

Table VIII presents a summary of the IOA recommended failure criticalities for the GNC major components for the Post 51-L FMEA baseline.

TA	TABLE VIII GNC Major Components Summary of IOA Recommended Failure Criticalities									
Cr	iticality:	1/1	2/1R	2/2	3/1R	3/2R	3/3	TOTAL		
1.	RHC	1	-	-	2	_	2	5		
2.	THC	_	1	_	2	-	_	3		
3.	RPTA	1	_	_	3	-	_	4		
4.	SBTC	-	2	_	4	-	_	6		
5.	IMU	_	1	_	1	-	_	2		
6.	ST	-	-	_	5	-	_	5		
7.	COAS	-	-	_	3	-	_	3		
8.	ADTA	-	-	_	2	-	_	2		
9.	RGA (ORB)	-	1	_	1	-	-	2		
10.	RGA (SRB)	-	1	_	1	_	_	2		
11.	AA	-	1	-	1	-	-	2		
12.	ASA	_	1	-	5	-	_	6		
13.	RJD	2	1	-	3	-	-	6		
14.	ATVC	-	1	-	3	_	-	4		
	TOTAL	4	10	0	36	0	2	52		

Table IX presents a summary of the IOA recommended CIL items for the GNC major components for the Post 51-L baseline.

TABLE IX	TABLE IX GNC Major Components Summary of IOA Recommended Critical Items						
Criticality	y: 1/1	2/1R	2/2	3/1R	3/2R	3/3	TOTAL
1. RHC	1	-	-	•	-		1
2. THC	-	1	-	-	-	-	1
3. RPTA	1	-	-	-	-	_	1
4. SBTC	-	2	-	-	-	-	2
5. IMU	-	1	_	1	-	-	2
6. ST	-	-	-	-	-	-	-
7. COAS	_	-	-	-	-	-	-
8. ADTA	-	_	-	-	-	-	-
9. RGA (OR	в) –	1	-	-	-	-	1
10. RGA (SR	в) –	1	_	-	-	-	1
11. AA	_	1	_	-	_	-	1
12. ASA	· -	1	_	-	-	-	1
13. RJD	2	1	_	_	_	-	3
14. ATVC	_	1	_	_	_	_	1
TOTAL	4	10	0	1	0	0	15

4.2 ASSESSMENT RESULTS - GNC FUNCTION SWITCHES AND CIRCUITS

Twelve groups of switches and circuits make up this category. A summary of the quantity of NASA FMEAs assessed for the GNC function switches and circuits, versus the recommended baseline, and any issues identified is presented in Table X.

Table X GNC Function Switches and Circuits Summary of IOA FMEA Assessment							
Component	NASA	IOA	Issues				
1. TRIM ENABLE INHIB SW'S	1	2	1				
2. TRIM SW'S	3	6	3				
3. TRIM ON/OFF SW'S	1	2	1				
4. SENSE -Z/-X SW	1	2	1				
5. P,R/Y CSS/ AUTO PBI'S	8	12	4				
6. SPD BK/THROT PBI	2	3	1				
7. BODY FLAP CNTL CKT	3	6	3				
8. ATT REF PBI	0	2	2				
9. ENTRY MODE SW	1	2	1				
10. ABORT MODE CKT	5	8	3				
11. DAP PBI'S	34	33	1				
12. FCS CHNL CNTL CKT	5	5	0				
TOTAL	64	83	21				

The issues resulted from IOA analyzing failure modes not covered by NASA. These failures did not raise the criticality of the component. NASA should consider generating FMEA's for completeness. The DAP PBI's issues are the results of the wording in the effects field.

A summary of the quantity of NASA CIL items assessed for the GNC function switches and circuits, versus the recommended IOA baseline, and any issues identified is presented in Table XI.

Table XI GN	C Function S Summary of	witches and C IOA CIL Asses	ircuits sment
Component	NASA	IOA	Issues
1. TRIM ENABLE INHIB SW'S	0	0	0
2. TRIM SW'S	0	0	0
3. TRIM ON/OFF SW'S	0	0	O
4. SENSE -Z/-X SW	0	0	0
5. P,R/Y CSS/ AUTO PBI'S	2	2	0
6. SPD BK/THROT PBI	О	0	o
7. BODY FLAP CNTL CKT	o	0	o
8. ATT REF PBI	o	o	0
9. ENTRY MODE SW	o	0	o
10. ABORT MODE CKT	3	3	0
11. DAP PBI'S	4	4	0
12. FCS CHNL CNTL CKT	0	0	0
TOTAL	9	9	0

Table XII presents a summary of the IOA recommended failure criticalities for the GNC function switches and circuits for the Post 51-L FMEA baseline.

+	+							
T.	TABLE XII GNC Function Switches and Circuits Summary of IOA Recommended Failure Criticalities							
С	riticality:	1/1	2/1R	2/2	3/1R	3/2R	3/3	TOTAL
1.	TRIM ENABLE INHIB SW'S	-	-	-	-	-	2	2
2.	TRIM SW'S	-	-	_	_	-	6	6
3.	TRIM ON/OFF SW'S	-		-	_	-	2	2
4.	SENSE -Z/-X SW	_	-	-	_	_	2	2
5.	R,P/Y CSS/ AUTO PBI'S	2	_	-	10	-	-	12
6.	SPD BK/THROT PBI	-	-	-	-	_	3	3
7.	BODY FLAP CNTL CKT	-	-	-	6	_	_	6
8.	ATT REF PBI	-	-	-	2	-	_	2
9.	ENTRY MODE SW	-	_	-	-	-	2	2
10.	ABORT MODE CKT	1	2	-	5	-	-	8
11.	DAP PBI'S	-	-	10	-	22	1	33
12.	FCS CHNL CNTL CKT	-	-	-	3	-	2	5
	TOTAL	3	2	10	26	22	20	83

Table XIII presents a summary of the IOA recommended CIL items for the GNC function switches and circuits for the Post 51-L baseline.

TABLE XIII GN Summa	TABLE XIII GNC Function Switches and Circuits Summary of IOA Recommended Critical Items						
Criticality:	1/1	2/1R	2/2	3/1R	3/2R	3/3	TOTAL
1. TRIM ENABLE INHIB SW'S	-	-	-	-	_	-	0
2. TRIM SW'S	-	-	-	-	-	-	0
3. TRIM ON/OFF SW'S	-	- .	-	-	-	-	0
4. SENSE -Z/-X SW	-	-	-	-	· -	-	0
5. R,P/Y CSS/ AUTO PBI'S	2	-		-	-	-	2
6. SPD BK/THROT PBI	-	-	-	-	-	-	0
7. BODY FLAP CNTL CKT	-	-	-	-	-	-	0
8. ATT REF PBI	-	-	_	-	-	-	-
9. ENTRY MODE SW	-	-	-	-	-	-	-
10. ABORT MODE CKT	1	2	-	-	_	-	3
11. DAP PBI'S	_	-	4	-	-	-	4
12. FCS CHNL CNTL CKT	-	-	-	-	-	-	0
TOTAL	3	2	4	-	-	-	9

4.3 ASSESSMENT RESULTS - GNC POWER SWITCHES AND CIRCUITS

Twelve groups of switches and circuits make up this category. A summary of the quantity of NASA FMEAs assessed for the GNC power switches and circuits, versus the recommended baseline, and any issues identified is presented in Table XIV.

Table XIV GNC Power Switches and Circuits Summary of IOA FMEA Assessment						
Component	NASA	IOA	Issues			
1. FLT CNTLR PWR CKT	4	3	0			
2. IMU PWR CKT	6	3	2			
3. ST PWR CKT	1	2	o			
4. COAS PWR CKT	1	1	o			
5. ADTA PWR CKT	2	3	o			
6. RGA (ORB) PWR CKT	5	4	0			
7. AA PWR CKT	6	7	o			
8. ASA PWR CKT	8	2	2			
9. RJD PWR CKT	0	4	4			
10. ATVC PWR CKT	7	7	0			
11. FCS SW ANNUN CKT	7	3	o			
12. RGA (SRB) PWR CKT	1	1	o			
TOTAL	48	40	8			

Issues resulted from Interpretation of NSTS 22206, Instruction for Preparation of FMEA and CIL. IOA treated the circuitry as black boxes, and NASA evaluated the components of the black boxes. The RJD PWR CKT was not covered by NASA. However, the failures covered by IOA did not raise the criticality of the component.

A summary of the quantity of NASA CIL items assessed for the GNC power switches and circuits, versus the recommended IOA baseline, and any issues identified is presented in Table XV.

Table XV		vitches and Ci	
Component	NASA	IOA	Issues
1. FLT CNTLR PWR CKT	2	2	0
2. IMU PWR CKT	1	1	0
3. ST PWR CKT	0	0	0
4. COAS PWR CKT	0	0	0
5. ADTA PWR CKT	О	0	0
6. RGA (ORB) PWR CKT	1	1	o
7. AA PWR CKT	1	1	0
8. ASA PWR CKT	3	3	0
9. RJD PWR CKT	0	0	0
10. ATVC PWR CKT	3	3	o
11. FCS SW ANNUN CKT	0	0	O
12. RGA (SRB) PWR CKT	1	1	0
TOTAL	12	12	0

Table XVI presents a summary of the IOA recommended failure criticalities for the GNC power switches and circuits for the Post 51-L FMEA baseline.

TABLE XVI	TABLE XVI GNC Power Switches and Circuits Summary of IOA Recommended Failure Criticalities						
Criticality:	1/1	2/1R	2/2	3/1R	3/2R	3/3	TOTAL
1. FLT CNTLR PWR CKT	-	1	-	1	-	1	3
2. IMU PWR CKT	-	-	-	2	-	1	3
3. ST PWR CKT	-	-	_	2	-	_	2
4. COAS PWR CKT	-	-	_	1	-	-	1
5. ADTA PWR CKT	-	-	-	1	-	2	3
6. RGA (ORB) PWR CKT	_	-	_	4		-	4
7. AA PWR CKT	-	-	-	5	-	2	7
8. ASA PWR CKT	-	-	-	1	-	1	2
9. RJD PWR CKT	-	-	-	2	-	2	4
10. ATVC PWR CKT	-	1,	-	5	-	1	7
11. FCS SW ANNUN CKT	-	-	-	3	-	-	3
12. RGA (SRB) PWR CKT	-	-	-	1	-	-	1
TOTAL	-	2	-	28	-	10	40

Table XVII presents a summary of the IOA recommended CIL items for the GNC power switches and circuits for the Post 51-L baseline.

TABLE XVII	TABLE XVII GNC Power Switches and Circuits Summary of IOA Recommended Critical Items						
Criticality:	1/1	2/1R	2/2	3/1R	3/2R	3/3	TOTAL
1. FLT CNTLR PWR CKT	-	1	1	-	-	-	2
2. IMU PWR CKT	-	-	-	1	-	-	1
3. ST PWR CKT	-	-	-	-	-	-	-
4. COAS PWR CKT	-	-	_	-	-	-	-
5. ADTA PWR CKT	-	-	-	-	-	-	-
6. RGA (ORB) PWR CKT	-	-	-	1	-	-	1
7. AA PWR CKT	-	-	-	1	-	-	1
8. ASA PWR CKT	-	1	-	2	-	-	3
9. RJD PWR CKT	-	-	_	-	-	-	_
10. ATVC PWR CKT	-	1	_	2	_	-	3
11. FCS SW ANNUN CKT	-	-	-	-	-	-	-
12. RGA (SRB) PWR CKT	-	-	-	1	-	-	1
TOTAL	_	3	1	8	-	-	12

5.0 REFERENCES

Reference documentation available from NASA and Rockwell was used in the analysis. The documentation used included the following:

- 1. JSC-1886, Guidance and Control Systems Briefs, 9-30-85
- 2. CONT 2102, Controllers Workbook, 2-1-82
- 3. GNC HS OV 2102, GNC Hardware/Software Overview, 5-17-84
- 4. JSC-12820, STS operational Flight Rules, PCN-1, 2-14-86
- 5. VS70-971099, Integrated System Schematic GNC & Data Processing, OV-099 & OV-103, 4-11-86
- 6. VS70-790129, Schematic Diagram Rotational Hand Controller, 10-22-80
- 7. VS70-790159, Schematic Diagram Translational Hand Controller, 1-14-81
- 8. VS70-790149, Schematic Diagram Rudder Pedal Transducer Assembly, 1-12-81
- 9. VS70-971099, Schematic Diagram Speed Brake Thrust Controller, 11-17-80
- 10. VS70-710109, Schematic Diagram, Inertial Measurement Unit, 11-12-80
- 11. VS70-710149, Schematic Diagram, Star Tracker, 11-18-80
- 12. VS70-590309, Schematic Diagram, Air Data Probe Deployment and Heater, 11-12-80
- 13. VS70-710152, Schematic Diagram, Orbiter Rate Gyro & Navigation Subsystem, 3-24-75
- 14. VS70-790119, Schematic Diagram, Accelerometer Assembly, 10-30-80
- 15. VS70-790229, Schematic Diagram, Aerosurface Servo Amplfier, 12-10-80
- 16. VS70-420109,209,309, Schematic Diagram, RCS Fwd, Aft Right, & Aft Left Modules, March 1980
- 17. VS70-790239, Schematic Diagram, Ascent Thrust Vector Control-Flt Control Subsystem, 3-18-81
- 18. STS82-0028, Orbiter Vehicle Operational Configuration Failure Mode Effects Analysis GN&C, 1-28-83
- 19. STS82-0033, 05-60 GN&C/EPD&C FMEAs, 5-1-83

- 20. STS82-0039A, Avionics Systems Critical Items List, 6-18-84
- 21. Post 51-L FMEAs
 - A. GN&C FMEA Orville Littleton, Dec '86
 - B. GN&C FMEA Tom Lewis, 11-5-86
 - C. GN&C FMEA Fred McAllister, Dec '86 D. GN&C FMEA Andy Saulietis, 11-17-86

 - E. IMU FMEA Malcolm Jones, 1-26-87
- 22. NSTS 22206, Instruction for Preparation of FMEA and CIL, 10 October 1986.

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APPENDIX A

Accelerometer Assembly AA Annunciator Control Assembly ACA Analog to Digital A/D Attitude Direction Indicator ADI ADTA -Air Data Transducer Assembly Analog Input Differential AID Aft Load Controller ALC Abort Once Around AOA Aft Power Controller APC Aerosurface Servo Amplifier ASA ATO - Abort To Orbit ATVC - Ascent Thrust Vector Control - Body Flap BF Backup Flight System BFS BITE -Built-In Test Equipment Circuit Breaker CB Critical Items List CIL CKT Circuit Controller CNTLR -Crew Optical Alignment Sight COAS -CRIT -Criticality Cathode Ray Tube CRT CSS Control Stick Steering Caution and Warning System C&W Digital Auto Pilot DAP Display Driver Unit DDU DEU Display Electronics Unit DISC Discrete Data Processing System DPS DU Display Unit Engine Interface Unit EIU EVA Extra Vehicular Activity - Flight Aft FCOS - Flight Control Operating System - Flight Control System FCS Fault Detection, Identification, Reconfiguration FDIR FF Flight Forward Failure Mode FMEA - Failure Mode and Effects Analysis FSM Fault Summary Message Functional Subsystem Software Requirements FSSR -FSW Flight Software Function FUNC General Purpose Computer GPC GSE Ground Support Equipment H/W - Hardware

Inertial Measurement Unit

Independent Orbiter Assessment

IMU -IOA - LF - Launch Forward

LL Launch Left

LPS - Launch Processing System

- Launch Right LR

- Line Replaceable Unit LRU

MAN Manual

MC - Memory Configuration - Mission Control Center MCC

MCDS - Multifunction CRT Display System
MDAC - McDonnell Douglas Astronautics Company

MDM Multiplexer/Demultiplexer - Main Engine Controller MEC

MM

Major ModeManual Select Keyboard MSK

MVS - Mid Value Select - Not Applicable NA

NASA - National Aeronautics and Space Administration

NORM - Normal

NSTS - National Space Transportation System

- Operational Aft OA

OF - Operational Forward
OMRSD - Operational Maintenance Requirements and Specifications

Document

OMS Orbital Maneuvering System

OPS - Operational Sequence

- Pitch P

PBI - Pushbutton Indicator PCI - Potential Critical Item PCM Pulse Code Modulation

- Position POS

- Roll R

RCS - Reaction Control System

RGA Rate Gyro Assembly

RHC - Rotational Hand Controller

RI - Rockwell International RJD - Reaction Jet Driver - Redundancy Management RM

- Rotation ROT

RPC - Remote Power Controller

RPTA - Rudder Pedal Transducer Assembly RS - Redundant Set

RTLS - Return To Landing Site

SBTC - Speed Brake Thrust Controller

SF - Selection Filter - Systems Management SM

- Subsystem Operating Program SOP

- Solid Rocket Booster SRB

SSME - Space Shuttle Main Engine

- Star Tracker ST

Space Transportation System STS

SW Switch S/W -Software TAL - Transatlantic Abort Landing

TD - Touch Down

THC - Translational Hand Controller

TRANS - Translation

TVC - Thrust Vector Control VDC - Volts Direct Current

VERN - Vernier

Y - Yaw

APPENDIX B

DEFINITIONS, GROUND RULES, AND ASSUMPTIONS

- B.1 Definitions
 B.2 Project Level Ground Rules and Assumptions
 B.3 Subsystem-Specific Ground Rules and Assumptions

APPENDIX B DEFINITIONS, GROUND RULES, AND ASSUMPTIONS

B.1 Definitions

Definitions contained in <u>NSTS 22206</u>, <u>Instructions For Preparation of FMEA/CIL</u>, 10 October 1986, were used with the following amplifications and additions.

INTACT ABORT DEFINITIONS:

RTLS - begins at transition to OPS 6 and ends at transition
to OPS 9, post-flight

<u>TAL</u> - begins at declaration of the abort and ends at transition to OPS 9, post-flight

<u>AOA</u> - begins at declaration of the abort and ends at transition to OPS 9, post-flight

ATO - begins at declaration of the abort and ends at transition to OPS 9, post-flight

<u>CREDIBLE (CAUSE)</u> - an event that can be predicted or expected in anticipated operational environmental conditions. Excludes an event where multiple failures must first occur to result in environmental extremes

<u>CONTINGENCY CREW PROCEDURES</u> - procedures that are utilized beyond the standard malfunction procedures, pocket checklists, and cue cards

<u>EARLY MISSION TERMINATION</u> - termination of onorbit phase prior to planned end of mission

 $\underline{\text{EFFECTS/RATIONALE}}$ - description of the case which generated the highest criticality

HIGHEST CRITICALITY - the highest functional criticality determined in the phase-by-phase analysis

<u>MAJOR MODE (MM)</u> - major sub-mode of software operational sequence (OPS)

MC - Memory Configuration of Primary Avionics Software System
(PASS)

MISSION - assigned performance of a specific Orbiter flight with payload/objective accomplishments including orbit phasing and altitude (excludes secondary payloads such as GAS cans, middeck P/L, etc.)

<u>MULTIPLE ORDER FAILURE</u> - describes the failure due to a single cause or event of all units which perform a necessary (critical) function

OFF-NOMINAL CREW PROCEDURES - procedures that are utilized beyond the standard malfunction procedures, pocket checklists, and cue cards

OPS - software operational sequence

<u>PRIMARY MISSION OBJECTIVES</u> - worst case primary mission objectives are equal to mission objectives

PHASE DEFINITIONS:

PRELAUNCH PHASE - begins at launch count-down Orbiter
power-up and ends at moding to OPS Major Mode 102 (liftoff)

<u>LIFTOFF MISSION PHASE</u> - begins at SRB ignition (MM 102) and ends at transition out of OPS 1 (Synonymous with ASCENT)

ONORBIT PHASE - begins at transition to OPS 2 or OPS 8 and ends at transition out of OPS 2 or OPS 8

<u>DEORBIT PHASE</u> - begins at transition to OPS Major Mode 301 and ends at first main landing gear touchdown

<u>LANDING/SAFING PHASE</u> - begins at first main gear touchdown and ends with the completion of post-landing safing operations

APPENDIX B DEFINITIONS, GROUND RULES, AND ASSUMPTIONS

B.2 IOA Project Level Ground Rules and Assumptions

The philosophy embodied in NSTS 22206, Instructions for Preparation of FMEA/CIL, 10 October 1986, was employed with the following amplifications and additions.

1. The operational flight software is an accurate implementation of the Flight System Software Requirements (FSSRs).

RATIONALE: Software verification is out-of-scope of this task.

2. After liftoff, any parameter which is monitored by system management (SM) or which drives any part of the Caution and Warning System (C&W) will support passage of Redundancy Screen B for its corresponding hardware item.

RATIONALE: Analysis of on-board parameter availability and/or the actual monitoring by the crew is beyond the scope of this task.

3. Any data employed with flight software is assumed to be functional for the specific vehicle and specific mission being flown.

RATIONALE: Mission data verification is out-of-scope of this task.

4. All hardware (including firmware) is manufactured and assembled to the design specifications/drawings.

RATIONALE: Acceptance and verification testing is designed to detect and identify problems before the item is approved for use.

5. All Flight Data File crew procedures will be assumed performed as written, and will not include human error in their performance.

RATIONALE: Failures caused by human operational error are out-of-scope of this task.

6. All hardware analyses will, as a minimum, be performed at the level of analysis existent within NASA/Prime Contractor Orbiter FMEA/CILs, and will be permitted to go to greater hardware detail levels but not lesser.

RATIONALE: Comparison of IOA analysis results with other analyses requires that both analyses be performed to a comparable level of detail.

7. Verification that a telemetry parameter is actually monitored during AOS by ground-based personnel is not required.

RATIONALE: Analysis of mission-dependent telemetry availability and/or the actual monitoring of applicable data by ground-based personnel is beyond the scope of this task.

8. The determination of criticalities per phase is based on the worst case effect of a failure for the phase being analyzed. The failure can occur in the phase being analyzed or in any previous phase, whichever produces the worst case effects for the phase of interest.

RATIONALE: Assigning phase criticalities ensures a thorough and complete analysis.

9. Analysis of wire harnesses, cables, and electrical connectors to determine if FMEAs are warranted will not be performed nor FMEAs assessed.

RATIONALE: Analysis was substantially complete prior to NSTS 22206 ground rule redirection.

10. Analysis of welds or brazed joints that cannot be inspected will not be performed nor FMEAs assessed.

RATIONALE: Analysis was substantially complete prior to NSTS 22206 ground rule redirection.

11. Emergency system or hardware will include burst discs and will exclude the EMU Secondary Oxygen Pack (SOP), pressure relief valves and the landing gear pyrotechnics.

RATIONALE: Clarify definition of emergency systems to ensure consistency throughout IOA project.

APPENDIX B DEFINITIONS, GROUND RULES, AND ASSUMPTIONS

- B.3 GNC Specific Ground Rules and Assumptions
- 1. The failure analyses will be conducted to the black box level for components whose output serves only one function unless a lower level is required to be consistent with the existing FMEAs.

RATIONALE: The definition credible failure modes are oriented toward the black box functional output.

2. For black boxes whose output serves more than one function, the analysis will go to a level that effects each of the different functions.

RATIONALE: The defined credible failure modes are oriented toward the black box functional output.

- 3. Credible failure modes for most black boxes are defined to be
 - (1) No output
 - (2) Erroneous output (Output that redundancy management will detect as a failure.)
 - (3) Premature output (Output occurs without command. This may not be credible for all black boxes.)

RATIONALE: Covers worst case effects on function.

- 4. Credible failures for switches are defined to be
 - (1) Fails on (Power cannot be shut off by switch.)
 - (2) Fails off (Power cannot be turned on.)
 - (3) Short to ground
 - (4) Internal short (Short across switch contacts.)

RATIONALE: Covers worst case effects on function.

5. Power circuits analysis does not include the resistors that reside between the power circuit and a MDM.

RATIONALE: These resistors provide signal conditioning for the MDM and are not a part of the power circuit.

APPENDIX C DETAILED ASSESSMENT

This section contains the IOA assessment worksheets generated during the Assessment of the Guidance, Navigation, and Control Subsystem. The information on these worksheets facilitates the comparison of the NASA FMEA/CIL (Pre and Post 51-L) to the IOA detailed analysis worksheets included in Appendix E. Each of these worksheets identifies the NASA FMEA being assessed, corresponding MDAC Analysis Worksheet ID (Appendix E), hardware item, criticality, redundancy screens, and recommendations. For each failure mode, the highest assessed hardware and functional criticality is compared and discrepancies noted as "N" in the compare row under the column where the discrepancy occurred.

LEGEND FOR IOA ASSESSMENT WORKSHEETS

Hardware Criticalities:

1 = Loss of life or vehicle

2 = Loss of mission or next failure of any redundant item (like or unlike) could cause loss of life/vehicle

3 = All others

Functional Criticalities:

1R = Redundant hardware items (like or unlike) all of which,

if failed, could cause loss of life or vehicle

2R = Redundant hardware items (like or unlike) all of which, if failed, could cause loss of mission

Redundancy Screens A, B and C:

P = Passed Screen

F = Failed Screen

NA = Not Applicable

NASA Data:

Baseline = NASA FMEA/CIL

New = Baseline with Proposed Post 51-L Changes

CIL Item :

X = Included in CIL

Compare Row:

N = Non compare for that column (deviation)

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	CNO_101		A DATA: SELINE [] NEW [X]
SUBSYSTEM: MDAC ID: ITEM:	GNC 101 RHC		
LEAD ANALYST:	ROBERT O'DONN	IELL	
ASSESSMENT:			
CRITICAL: FLIGHT	ŗ	DANCY SCREENS	CIL ITEM
HDW/FUI	IC A	В С	
NASA [1 /1 IOA [2 /1R] [NA]] [P]	[NA] [NA] [P]	[X] * [X]
COMPARE [N /N] [N]	[и] [иј	[]
RECOMMENDATIONS:	(If differe	nt from NASA)	
[/] []	[] []	[] (ADD/DELETE)
* CIL RETENTION F	ATIONALE: (If	applicable)	
REMARKS:		ADEQ INADEQ	UATE [X] UATE []
IOA FAILURE MODE: FMEA FAILURE MODE	: PHYSICAL JAI	MMTNG.	
IOA DOES CONCUR WIN THE NASA-JSC F	TTH NASA'S REI MEA REVIEW COI	EVALUATION AND RA	C CHOILD TAM
DURING THE CRITIC	AL ENTRY FLIGI	HT PHASE OF FINAL	FLARE AND LANDING

APPROACH MANEUVERS, LOSS OF CONTROL COULD CAUSE LOSS OF VEHICLE. IOA DOES NOT RECOMMEND A CHANGE TO THE REVISED NASA FMEA.

ASSESSME	ASSESSMENT DATE: 1/23/87 ASSESSMENT ID: GNC-102 NASA FMEA #: 05-1-FC3042-2							-2					_	ASA DA BASELI N	NE	[x :))	
SUBSYSTE MDAC ID: ITEM:				GNC 102 RHC	02 HC														
LEAD ANA	LYS	ST	:	ROBE	ERT	0'	DO	NNE	LL										
ASSESSME	NT	:																	
		F	ICALI LIGHT W/FUI	ľ		F		UNE)AN(CY B	SCF	REEN	s C			CI IT	L EM		
NASA IOA	[3	/1R /1R]		[E))		[P P]	[P P]		[:]	*
COMPARE	[/]		[]		[]	[]		[]	
RECOMMEN	DA!	ri	ons:	(1	[f (lif	fe	rer	nt :	fr	om N	IASA)						
	[/]		[]		[]	[]	(A	[DD/	DE:] LE	TE
* CIL RE	TE	NT:	ION 1	RATIO	ONA:	LE:	(Ιf	apj	p1 :	icak			DEQUAT DEQUAT]	
REMARKS: IOA FAII FMEA FAI NO DIFFE	URI LUI	RE	MOD												TC	н.			

ASSESSMENT ASSESSMENT NASA FMEA #					ASA DAT BASELIN NE	ΙE	[x]						
SUBSYSTEM: MDAC ID: ITEM:		GNC 103 RHC	03 HC												
LEAD ANALYS	T:	ROBERT	ני כ	ו' כ	OONNE	LL									
ASSESSMENT:															
	TICAL:			RI	EDUNDA	ANCY	SCR	EENS	5			CI	L EM		
H	E	3		С											
NASA [3 /1R 3 /1R]	[P P]	[F]	[[P P]		[]	*
COMPARE [/	3	[]	[]	[]		[]	
RECOMMENDAT	ions:	(If	di	ifi	ferent	fr	om N	ASA)							
[/]	[]	[]	[ΆΓ	[DD/] LE	TE)
* CIL RETEN	TION 1	RATIONA	ALE	E:	(If a	appl	icab	•		EQUATE		[]	
REMARKS: IOA FAILURE FMEA FAILUR NO DIFFEREN	E MODI												н.		

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	GNC-104	NC-104 BASELINE []						
MDAC ID:	GNC 104 RHC							
LEAD ANALYST:	ROBERT (O'DONNEL	L					
ASSESSMENT:								
CRITICAL: FLIGH		REDUNDA	NCY SCREI	ens	CIL ITEM			
	NC	A	В	С				
NASA [3 /1R IOA [3 /3] [P] NA]	[P] [NA]	[P] [NA]	[] *			
COMPARE [/N] [n j	[N]	[N]	[]			
RECOMMENDATIONS:	(If d	ifferent	from NAS	SA)				
[/] []	[]	[] (A	[] DD/DELETE)			
* CIL RETENTION	RATIONAL	E: (If a	pplicable	e) ADEQUATE INADEQUATE	[]			
REMARKS: IOA FAILURE MODE FMEA FAILURE MOD THE NASA FMEA CO MODE. SINCE THI	E: LOSS (VERS TWO	OF A CHN FAILURE	-TRANSDUC S WHICH :	CHN. CER OR SWITC	H. S IOA FAILURI			

Œ OTHER NASA FAILURE MODE, IOA DOES NOT RECOMMEND THAT A NEW FMEA BE WRITTEN.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/23/87 GNC-105 05-1-FC3042-3	NASA DATA: BASELINE [] NEW [X]									
SUBSYSTEM: MDAC ID: ITEM:	GNC 105 RHC										
LEAD ANALYST:	ROBERT O'DONNEL	L									
ASSESSMENT:											
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM											
HDW/FU	IC A	В С									
NASA [3 /1R IOA [3 /3] [P]] [NA]	[P] [P] [NA] [NA]	[] *								
COMPARE [/N] [N]	[и] [и]	[]								
RECOMMENDATIONS:	(If different	from NASA)									
1] []	[] []	[] (ADD/DELETE)								
* CIL RETENTION F	RATIONALE: (If a	pplicable) ADEQUAT INADEQUAT									
	E: ERRONEOUS OUT	-	SWITCH.								

MODE. SINCE THIS FAILURE MODE IS OF LOWER CRITICALITY THAN THE OTHER NASA FAILURE MODE, IOA DOES NOT RECOMMEND THAT A NEW FMEA

REPORT DATE 02/03/88

BE WRITTEN.

ASSESSMEI ASSESSMEI NASA FME	NT I		1/23/8 GNC-1: 05-6Q-	LO	3-2				NASA DATA BASELINE NEW]		
SUBSYSTEM MDAC ID:	4:		GNC 110 CIRCU	[T-F	LT C	ITLF	R PWR						
LEAD ANA	LYST	:	ROBER	r 0'	DONNE	ELL							
ASSESSME	NT:												
CRITICALITY REDUNDANCY SCREENS										CIL	CIL ITEM		
NASA IOA				[N	A]	[NA]		NA]	[] *		
	_	-			A]		NA]	_	NA]	•	J		
COMPARE	[/]	[]	ι]	[]	[]		
RECOMMEN	DATI	ons:	(If	dif	fere	nt i	from NA	ASA))				
	[/	1	[]	[1	[] (A)	[DD/DI] ELETE)		
* CIL RE	PENT	ION :	RATION	ALE:	(If	app	plicabl		ADEQUATE ADEQUATE	[]		
REMARKS:													

IOA FAILURE MODE: CB OR SW FAILS CLOSED. FMEA FAILURE MODE: SW FLS CLOSED IN "ON" POSITION. NO DIFFERENCES. IF SWITCH FAILS ON, THE FLIGHT CONTROLLER POWER CAN BE TURNED OFF BY THE ASSOCIATED DDU CIRCUIT BREAKERS.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:		NASA DATA: BASELINE [] NEW [X]						
MDAC ID:	GNC 111 CIRCUIT-FLT CNTLR PWR							
LEAD ANALYST:	ROBERT O'DONNELL							
ASSESSMENT:								
CRITICALI FLIGHT	ITY REDUNDANCY SCREENS	CIL ITEM						
HDW/FUN	C							
NASA [3 /1R IOA [3 /1R] [P] [F] []	P] [X] * P] []						
COMPARE [/] [] [N] [] [N]						
RECOMMENDATIONS:	(If different from NASA)							
[/] [] [] [] [] (ADD/DELETE)						
* CIL RETENTION F	RATIONALE: (If applicable) INI INI	ADEQUATE [] ADEQUATE []						
FMEA FAILURE MODE AFTER NASA/RI REE SYSTEM OPERATION,	: CB OR SW FAILS OPEN, OR SI E: CIRCUIT BREAKIER-LOSS OF EVALUATION OF FMEA AND FURTI , IOA DOES CONCUR WITH THE I	HORTED TO GROUND, F OUTPUT, OPENS. HER IOA EVALUATION OF REVISED FMEA. ONE						
CBs FL OPEN ARE N	T BREAKER (CB) FL OPEN IS NO NOT DETECTABLE, BUT THE RESU	OT DETECTABLE. TWO ULTING LOSS OF THE DDU						

POWER SUPPLIES (A, B, C) ARE DETECTABLE. SINCE CB FL CLOSE IS A 3/3, AND DOES NOT UPGRADE OPEN FAIL MODE 3/1R, IOA DOES NOT RECOMMEND A NEW FMEA FOR THE CLOSE FL MODE. THE CIL WAS NOT

AVAILABLE FOR EVALUATION OF THE RETENTION RATIONALE.

	1/23/87 GNC-111A 05-6Q-220	3-1		NASA DATA: BASELINE NEW					
	GNC 111 CIRCUIT-F	LT CNTLR							
LEAD ANALYST:									
ASSESSMENT:									
CRITICALITY REDUNDANCY SCREENS CITY HDW/FUNC A B C									
NASA [2 /1R IOA [3 /1R] [P] []	?][P] P]	[X] *				
COMPARE [N /] [] [] []	[N]				
RECOMMENDATIONS:	(If dif	ferent fi	com NASA)	•					
[/] [] [] [] (AI	[] DD/DELETE)				
* CIL RETENTION	RATIONALE:	(If app	•	ADEQUATE NADEQUATE					
REMARKS: IOA FAILURE MODE: CB OR SW FAILS OPEN, OR SHORTED TO									

IOA FAILURE MODE: CB OR SW FAILS OPEN, OR SHORTED TO GROUND. FMEA FAILURE MODE: SW FLS CLOSED IN "OFF" POSITION, SHORT TO GROUND AT "ON" POSITION CONTACTS, POLE-TO-POLE SHORT. IOA INITIALLY CONSIDERED THE SWITCH CONTACT FAIL OPEN MODE, WHICH PROVIDED THE CRITICALITY OF 3/1R. AFTER NASA/RI REEVALUATION OF FMEA AND FURTHER IOA EVALUATION OF SYSTEM OPERATION, IOA DOES CONCUR WITH THE REVISED FMEA CRITICALITY OF 2/1R FOR THE SWITCH FAILURE MODES. THE LEFT AND RIGHT FLT CNTRL SWS FAILED IN THE OFF POSITION RESULTS IN THE LOSS OF THE PLT'S AND CDR'S FLIGHT CONTROLLERS AND PROBABLE LOSS OF VEHICLE CONTROL. THE CIL WAS NOT AVAILABLE FOR EVALUATION OF THE RETENTION RATIONALE.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:		D) PREL	NASA DATA BASELINE NEW						
SUBSYSTEM: MDAC ID: ITEM:	111	11 IRCUIT-FLT CNTLR PWR							
LEAD ANALYST:	ROBERT O'DONNE	LL							
ASSESSMENT:									
CRITICAL FLIGH	ITY REDUNDA	ANCY SCREENS	3	CIL ITEM					
HDW/FU	NC A	В	С						
NASA [2 /2 IOA [3 /1R] [P]] [P]	[P] [[P]	P] P]	[X] *					
COMPARE [N /N] []	[] []	[N]					
RECOMMENDATIONS:	(If different	t from NASA)						
[/] []	[] [] (AI	[] DD/DELETE)					
* CIL RETENTION	RATIONALE: (If a	applicable)	3 DEOU3 ME						
DEM DVG		II	ADEQUATE ADEQUATE	[]					
REMARKS: IOA FAILURE MODE FMEA FAILURE MODE POSITION, SHORT: SHORT.	E: AFT PWR CNTLI	S OPEN, OR S R SW FAILED	SHORTED TO CLOSED IN	GROUND.					
NASA AND IOA INIT SWITCHES AS A GRO AFTER FURTHER EVA	OUP WITH FAILURE	OFF (OPEN)	MODE OF C	CRIT 3/1R.					
WITH THE NEW FMEATHE LOSS OF THE ATTO PERFORM MISSIC WAS NOT AVAILABLE	A FAIL OFF (OPEN AFT FLT CNTLR'S ONS REQUIRING RE	N) MODE FOR (RHC/THC) N ENDEZVOUS AN	AFT FLT CN WOULD MAKE ND PROX OPS	TLR PWR SW. IT DIFFICULT THE CIL					

ASSESSME ASSESSME NASA FME	NT II	D:			1-0	001	ASA D BASEL		[x]			
SUBSYSTEM MDAC ID:	M:		GNC 120 SWIT	CH-TR	M E								
LEAD ANA	L _. YST	:	ROBI	ERT O'I	ONN	ELL							
ASSESSME	NT:												
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM													
	HD	W/FU	NC	A		E	3	C	3				
NASA IOA	[3	/3 /3]	[NZ	A] A]	[N	IA] IA]	[]	IA] IA]		[[]	*
COMPARE	ĺ	/]	[]	[]	[3		[]	
RECOMMEN	DATI	ons:	(:	If dif	fere	nt fi	com N	ASA)					
	[/]	[]	[]	[]	(Al		DELI	ETE)
* CIL RE	TENT	ION	RATI	ONALE:	(If	app]	Licab	1	ADEQU <i>I</i> ADEQU <i>I</i>]	
REMARKS: IOA FAII	URE							CLOS	ED (I	NHIB:	IT	POS:	ITION)

NO DIFFERENCES.

ASSESSMI ASSESSMI NASA FMI	ENT I ENT : EA # :	DATE: ID: :	1/23 GNC- 05-1	/87 121 -FC	7241-0	0001			NASA I BASEI	DATA: LINE [NEW [] X]	
SUBSYSTE MDAC ID:			GNC 121 SWIT	CH-1	TRIM E	NABI	LE/INF	HIBIT	1			
LEAD ANA	LYSI	r:	ROBE	RT C	O' DONN	ELL						
ASSESSMENT:												
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM HDW/FUNC A B C												
NASA IOA	[3	3 /3]	[NA] NA]	[] *	r				
COMPARE	[/]	[]	[]	[]	[]	
RECOMMEN	DATI	ons:	(I	f di	ffere	nt f	rom N	IASA)				
	[/]	[]	[]	[]	[(ADD/I] DELET	'E)
* CIL RE	TENI	ON:	RATIO	VALE	: (If	app	licab	•				
DEWL DVC -									ADEQUA ADEQUA]]	
IOA FAIL OR SHORT FMEA FAI	EMARKS: DA FAILURE MODE: SW CONTACT OR CURRENT LIMIT RESISTOR FAILS OPEN R SHORTED TO GROUND. MEA FAILURE MODE: ALL CREDIBLE MODES. D DIFFERENCES.											

ASSESSMENT DATE: 1/23/87 ASSESSMENT ID: GNC-130 NASA FMEA #: 05-1-FC7254-1							1				DATA ELINE NEW			
SUBSYSTE MDAC ID: ITEM:				GNC 130 SWI		RIM								
LEAD ANA	LYS	T:		ROE	BERT C) ' DON	NELL							
ASSESSME	SSESSMENT:													
CRITICALITY REDUNDANCY SCREENS FLIGHT HDW/FUNC A B C										CIL				
NASA IOA	[3	/3 /3]	[NA] NA]	[NA] NA]]	NA] NA]		[]	*
COMPARE	[/	1	[]	[]	[]		[]	
RECOMMEN	TAG	'IC	ns:	: ((If di	lffer	ent f	rom l	NASA))				
	[/]	[]	C)	[]	(A	[.DD/[ETE)
* CIL RI	ETEN	T	ON	RAT	IONALI	E: (I	f app	lica		ADEQ NADEQ	UATE UATE	[]	
REMARKS: IOA FAII FMEA FAI NO DIFFI	LURE I LUR	Œ	MOI	e: si De: 1	WITCH ALL C	CONT REDIB	ACT F	AILS DES-	CLO	SED.				

ASSESSMENT DATE: 1/23/87 ASSESSMENT ID: GNC-130A NASA FMEA #: 05-1-FC7255-1									NASA DAT BASELIN NE	Ε [x]	
SUBSYSTE MDAC ID:			GNC 130 SWITC	H-:	TRIM							
LEAD ANA	LYSI	::	ROBER	T (וממסם י	ELL						
ASSESSME	NT:											
		CICAL LIGH			REDUNI	OAN	CY SCR	EENS	S	CII		
	W/FU	-	A			В		С	ITI	SM		
NASA IOA		/3]	[NA] NA]]	NA] NA]		NA] NA]	[]	*
COMPARE	(/]	[]	[]	[1	[]	
RECOMMEN	DATI	ons:	(If	di	fferer	nt :	from N	ASA))			
	[/]	[]	[]	[] (2	[ADD/[ETE)
* CIL RE	TENT	'ION	RATION	ALE	E: (If	apı	plicab	·	ADEQUATE JADEQUATE	•]	
REMARKS: IOA FAIL FMEA FAI NO DIFFE	LURE	MOD						CLOS	SED.	L	J	

ASSESSMENT DATE: 1/23/87 ASSESSMENT ID: GNC-130B NASA FMEA #: 05-1-FC7256-1 SUBSYSTEM: GNC							NASA D BASEL		•]			
SUBSYSTE MDAC ID: ITEM:			GNC 130 SWITC	H-TI	RIM								
LEAD ANA	LYSI	! :	ROBER	T O	' DONN	ELL							
ASSESSME	NT:												
	F	'ICAL 'LIGH W/FU	_		REDUN A		Y SCR	EENS	c c		CIL		
NASA IOA	[3	/3]	[]	NA] NA]	[NA] NA]]	NA] NA]		[] *	ı
COMPARE	ſ	/]	[]	[]	[]		[]	
RECOMMEN	DATI	ons:	(If	di	ffere	nt f	rom N	ASA))				
	[/]	[]	[]	[)	(AI	`[D/D] ELET	'E)
* CIL RE								I	ADEQUA NADEQUA SED.		[]	
FMEA FAT	FMEA FAILURE MODE: ALL CREDIBLE MODES-YAW TRIM.												

NO DIFFERENCES.

ASSESSMENT ASSESSMENT NASA FMEA #	ID:	GNC-1	C-131 -1-FC7254-1			NASA DATA: BASELINE [] NEW [X]					x]
SUBSYSTEM: MDAC ID: ITEM:		GNC 131 SWITCH	H-TF	RIM							
LEAD ANALYS	T:	ROBERT	יס י	DONNE	ELL						
ASSESSMENT:											
	TICAL FLIGH		F		OANG	CY SCR B	EENS	s C		CI	
NASA [IOA [•		[N	IA] IA]]	NA] NA]	[NA] NA]		[] *
COMPARE [/]	[]	[]	[3		£]
RECOMMENDAT	'IONS:	(If	dif	ferer	nt i	from N	ASA)				
[/]	[]	[•]	ſ	1	(A)	[DD/1] DELETE)
* CIL RETEN	TION :	RATION?	ALE:	(If	app	plicab	•	ADEQU <i>A</i> IADEQU <i>A</i>]
REMARKS: IOA FAILURE FMEA FAILUR									ED '	ro (GROUND.

NO DIFFERENCES.

ASSESSMENT IN NASA FMEA #:				NASA DATA BASELINE NEW		
SUBSYSTEM: MDAC ID: ITEM:	GNC 131 SWITCH	-TRIM				
LEAD ANALYST	: ROBERT	O'DONNEI	LL			
ASSESSMENT:						
F	ICALITY LIGHT W/FUNC	REDUNDA A	ANCY SCREE	ens C	CIL ITEM	
NASA [3 IOA [3	/3] /3]	[NA] [NA]	[NA] [NA]	[NA] [NA]	[] *	
COMPARE [/]	[]	[]	[]	[]	
RECOMMENDATION	ONS: (If	different	from NAS	A)		
	/]	[]	[]	[] (A	[] DD/DELETE)	
* CIL RETENT	ION RATIONA	LE: (If a	applicable	ADEQUATE	[]	
REMARKS: IOA FAILURE MODE: SW CONTACT FAILS OPEN, OR SHORTED TO GROUND. FMEA FAILURE MODE: ALL CREDIBLE MODES-PITCH TRIM. NO DIFFERENCES.						

ASSESSME ASSESSME NASA FME	ASSESSMENT DATE: 1/23/87 ASSESSMENT ID: GNC-131B NASA FMEA #: 05-1-FC7256-1							NASA DAT BASELIN NE	E [x]		
SUBSYSTE MDAC ID:	M:		GNC 131 SWITCH	I-:	rim							
LEAD ANA	LYST:		ROBERT	r (O' DONNI	ELL						
ASSESSME	NT:											
	CRITICALITY REDUN FLIGHT					OAN	CY SCRE	EN	S		CL CEM	
			ic		A		В		С	1.	LEM	
NASA IOA	[3 ,	/3 /3]	[NA] NA]	[NA] NA]]	NA] NA]]]	*
COMPARE	[,	/]	[]	[]	[1	[]	
RECOMMEN	DATIO	NS:	(If	d:	ifferen	nt :	from NA	SA)			
	[,	/]	[]	[]	[DEL/	ETE)
* CIL RE	TENTI(ON F	RATION	\LI	E: (If	ap	plicabl	•	ADEQUATE NADEQUATE	[]	
FMEA FAI												

ASSESSME ASSESSME NASA FME	NT	ID	:	GNC-	-140	7242-0	001			NASA BASE		[[]	
SUBSYSTE MDAC ID: ITEM:				GNC 140 SWI	rch-1	TRIM O	N/01	F						
LEAD ANA	LYS	ST:		ROBI	ERT (o' Donn	ELL							
ASSESSME	NT:	:												
		FI	JGH	ITY IT INC		REDUN	D AN (CY SC	REENS	s C		CII		
WA CA			•				r	_	r	-		r	1	*
NASA IOA	[3	/3]	[NA]	[NA]	Ĺ	NA] NA]		į	j	
COMPARE	[/]	[]	[]	[]		[3	
RECOMMEN	IDA'	ric	NS:	: (:	If d	iffere	ent :	from	NASA)				
	ĺ		/]	[)	[]	[]	(A	[DD/I		ETE)
* CIL RE	: LURI	e n	10DE	e: sw	ITCH	CONT	ACT :	FAILS	II CLO	ADEQU NADEQU SED.	ATE ATE	[]	
FMEA FAI	LU	RE	MOI	DE: A	LL C	REDIBI	JE M	ODES.						

NO DIFFERENCES.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/23/87 GNC-141 05-1-FC7242-	0001	NASA DATA BASELINE NEV	
SUBSYSTEM: MDAC ID: ITEM:	GNC 141 SWITCH-TRIM	ON/OFF		
LEAD ANALYST:	ROBERT O'DON	NELL		
ASSESSMENT:				
CRITICAL: FLIGH	T	NDANCY SCRI		CIL ITEM
HDW/FU	NC A	В	С	
NASA [3 /3 IOA [3 /3] [NA]] [NA]	[NA] [NA]	[NA] [NA]	[] *
COMPARE [/] []	[]	[]	[]
RECOMMENDATIONS:	(If differ	ent from NA	ASA)	
[/] []	[]		[] .DD/DELETE)
* CIL RETENTION I	RATIONALE: (I	f applicabl	le)	
	(<u>-</u>	- app	ADEQUATE INADEQUATE	• •
REMARKS: IOA FAILURE MODE: OR SHORTED TO GRO FMEA FAILURE MODE NO DIFFERENCES.	OUND.		LIMIT RESIST	OR FAILS OPEN

ASSESSME ASSESSME NASA FME	NT :	ID:	GNC-	IC-150 BASELINI						[]		
SUBSYSTEMDAC ID:	M:		GNC 150 SWIT	CH-SE	NSE								
LEAD ANA	LYS	r:	ROBE	BERT O'DONNELL									
ASSESSME	NT:										•		
		TICAL FLIGH	T	R: A			Y SCR	EENS	s C		CII		
	H.	DW/FU	NC	A			5		•				
NASA IOA	[[3 /3 3 /3]	[N.	A] A]	[]	NA] NA]		NA] NA]		[]	*
COMPARE	[/]	[]	[]	(]		[]	
RECOMMEN	DAT	IONS:	(1	f dif	fere	nt f	rom N	IASA))				
	[/]	[]	[)	[]	(A	[DD/I) DEL	ETE)
* CIL RE		TION	RATIO	ONALE:	(If	app	licak		ADEQU NADEQU		[]	
REMARKS:	URE	MODE	E: SWI	ITCH C	ONTA	CT F	AILS DES.	CLO	SED.				

NO DIFFERENCES.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	GNC-151	001	NASA DATA BASELINI NEV	
SUBSYSTEM: MDAC ID: ITEM:	GNC 151 SWITCH-SENSE			
LEAD ANALYST:	ROBERT O'DONN	ELL		
ASSESSMENT:			,	
CRITICALI FLIGHT HDW/FUN	נ	DANCY SCR	EENS C	CIL ITEM
NASA [3 /3 IOA [3 /3] [NA]] [NA]	[NA] [NA]	[NA] [NA]	[] *
COMPARE [/] []	[]	[]	[]
RECOMMENDATIONS:	(If differer	nt from NA	ASA)	
[/] []	[]	[] (A)	[] .DD/DELETE)
* CIL RETENTION R	RATIONALE: (If	applicab]	le) ADEQUATE INADEQUATE	[]
REMARKS: IOA FAILURE MODE: OR SHORTED TO GRO FMEA FAILURE MODE NO DIFFERENCES	UND.		LIMIT RESIST	OR FAILS OPEN

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/23/87 GNC-160 05-1-FC7245-00	001	NASA DATA BASELINE NEW	
SUBSYSTEM: MDAC ID: ITEM:	GNC 160 SWITCH- P, R/Y	Y, CSS/AUTO		
LEAD ANALYST:	ROBERT O'DONNI	ELL		
ASSESSMENT:				
CRITICAL FLIGH		DANCY SCREEN	is	CIL ITEM
	NC A	В	С	
NASA [3 /3 IOA [3 /1R] [NA]	[NA] [[P] [NA] P]	[] *
COMPARE [/N] [N]	[и]	' и ј	[]
RECOMMENDATIONS:	(If differen	nt from NASA	٧)	
[1 /1] [NA]	[AN]	[NA]	[X] DD/DELETE)
* CIL RETENTION	RATIONALE: (If		ADEQUATE ADEQUATE	[]
REMARKS: IOA FAILURE MODE MODE: PITCH AUTO ON (PBI FAILED T IS 1/1.	PBI SW FAILS '	CT FAILS CLO TO TRANSFER.	SED. FMEA	FAILURE PBI FAILED
IF AUTO PBI SW F HOLD CSS PBI FOR CAN BE DESELECTE CONSIDERED AT TH	MANUAL CONTROL D FROM REDUNDAL IS TIME. THIS	L. IN ORBIT NCY MANAGEMI FAILURE WII	r (OPS 2/8) ENT. NO AU LL CAUSE A	, THE SWITCH TOLAND CHANGE

WORKLOAD.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/23/87 GNC-160A 05-1-FC72	46-0001	NASA DATA BASELINE NEW	_				
SUBSYSTEM: MDAC ID: ITEM:	GNC 160 SWITCH- P	, R/Y, CSS/	'AUTO					
LEAD ANALYST:	ROBERT O'	DONNELL						
ASSESSMENT:	ASSESSMENT:							
CRITICAL FLIGH	CIL ITEM							
HDW/FU	_	В	С	11211				
NASA [3 /3 IOA [3 /1R] [N	A] [NA]	[NA] [P]	[] *				
COMPARE [/N] [N] [и]	[N]	[]				
RECOMMENDATIONS:	(If dif	ferent from	n NASA)					
[3 /1R] [P] [P]		[] DD/DELETE)				
* CIL RETENTION RATIONALE: (If applicable) ADEQUATE []								
INADEQUATE [] REMARKS: IOA FAILURE MODE: SWITCH CONTACT FAILS CLOSED. FMEA FAILURE MODE: PITCH CSS PBI SW FAILS TO TRANSFER. IF CSS PBI FAILS ON, THERE IS NO MANUAL OVERRIDE CAPABILITY. WHEN IN ORBIT (OPS 2/8) THE SWITCH CAN BE DESELECTED FROM REDUNDANCY MANAGEMENT. THE MISSION CAN BE COMPLETED IN THE MANUAL CSS MODE FOR ENTRY.								

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/23/87 GNC-160B 05-1-FC7248-0	0001	NASA DATA BASELINI NEV	
SUBSYSTEM: MDAC ID: ITEM:	GNC 160 SWITCH- P, R	/Y, CSS/AU	TO	
LEAD ANALYST:	ROBERT O'DON	NELL		
ASSESSMENT:	•			
CRITICAL FLIGH	ITY REDUI	NDANCY SCR	EENS	CIL ITEM
	NC A	В	С	
NASA [3 /3 IOA [3 /1R] [NA]] [P]	[NA] [P]	[NA] [P]	[] *
COMPARE [/N] [N]	[N]	[и]	[]
RECOMMENDATIONS:	(If differe	ent from N	ASA)	
[1 /1] [P]	[P]		[X] ADD/DELETE)
* CIL RETENTION	RATIONALE: (I	f applicab	le) ADEQUATE	[]
			INADEQUATE	ί ϳ
REMARKS: IOA FAILURE MODE MODE: ROLL/YAW A FAILED ON (PBI F CRITICALITY IS 1 IF AUTO PBI SW F HOLD CSS PBI FOR CAN BE DESELECTE CONSIDERED AT TH IN OPERATING PRO WORKLOAD.	UTO PBI SW FAMILED TO TRANS /1. AILS ON, THE OF MANUAL CONTROPORTS TO FROM REDUND IS TIME. THIS	ILS TO TRA SFER OR JA CREW WILL OL. IN OR ANCY MANAG S FAILURE	NSFER. FOR MMED), THE WEBE REQUIRED BIT (OPS 2/8 EMENT. NO A WILL CAUSE A	AUTO PBI ORST CASE TO DEPRESS AND), THE SWITCH UTOLAND CHANGE

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/23/87 GNC-1600 05-1-FC	C 7249-000	01	NASA DATA: BASELINE [] NEW [X]				
SUBSYSTEM: MDAC ID: ITEM:	160	P, R/Y	, CSS/AUTO					
LEAD ANALYST:	ROBERT (O'DONNE	LL					
ASSESSMENT:								
FLIGHT	r		ANCY SCREE	NS	CIL ITEM			
HDW/FU	1C	A	В	С				
NASA [3 /3 IOA [3 /1R] [NA] P]	[NA] [P]	[NA] [P]	[] *			
COMPARE [/N] [n j	[N]	[N]	[]			
RECOMMENDATIONS:	(If di	ifferent	from NAS	A)				
[3 /1R] [P]	[P]		[] .DD/DELETE)			
* CIL RETENTION H	RATIONALE	E: (If a) ADEQUATE INADEQUATE	[]			
REMARKS: IOA FAILURE MODE: MODE: ROLL/YAW CS ON, THERE IS NO M 2/8), THE SWITCH THE MISSION CAN E	SS PBI SW MANUAL OV CAN BE D	V FAILS VERRIDE DESELECT	TAILS CLA TO TRANSFI CAPABILITY ED FROM RI	OSED. FMEA ER. IF CSS Y. WHEN IN EDUNDANCY M	FAILURE PBI FAILS ORBIT (OPS			

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/23/87 GNC-160D 05-1-FC7245-0002	NASA DATA: BASELINE [] NEW [X]									
	GNC 160 SWITCH- P, R/Y,	CSS/AUTO									
LEAD ANALYST:	ROBERT O'DONNELI	ı									
ASSESSMENT:											
FLIGH			CIL ITEM								
HDW/FU	NC A	ВС									
NASA [3 /3 IOA [3 /1R] [NA] [] [P]	NA] [NA] P] [P]	[] *								
COMPARE [/N] [N] [[и] [и]	[]								
RECOMMENDATIONS:	(If different	from NASA)									
[3 /1R] [P] [[P] [P] (AI	[] DD/DELETE)								
* CIL RETENTION	RATIONALE: (If ag	oplicable) ADEQUATE INADEQUATE	[]								
MODE: PITCH AUTO	PBI SW CONTACT-I	FAILS CLOSED. FMEA	FAILURE 3 CONTACT SW								

AND REQUIRES THE "AND" OF TWO CONTACTS FOR AN OUTPUT. IF AUTO

HOLD CSS PBI FOR MANUAL CNTL. IN ORBIT (OPS 2/8), THE SW CAN BE DESELECTED FROM RM. NO AUTOLAND CONSIDERED. THIS FAILURE WILL CAUSE A CHANGE IN OPERATING PROCEDURES AND INCREASE IN WORKLOAD.

PBI SW FLS ON, THE CREW WILL BE REQUIRED TO DEPRESS AND

C-27

ASSESSME ASSESSME NASA FME	NT NT A	D2 II #:	ATI D:	3:	1/1 GNO 05	/23/87 NC-160E 5-1-FC7246-0002										NZ I	ASA BAS	DA ELI N	TA: NE EW	[x]		
SUBSYSTE MDAC ID:					16	0	I –	P,	, F	R/Y,	. (cs	s/:	AUTC)									
LEAD ANA	'TAS	3 T :	:		RO	BERT	. (o'I	10C	NEI	L													
ASSESSME	:NT	:																						
		FI	LIG	SHI										CREE						CI				
	ŀ	HDV	N/I	U	IC			A				В				С								
NASA IOA]	3 3	/3	} LR]] [NA P	\]		[NZ P	A]]	NA P]			[]	*	
COMPARE	[/N	1]		[N]		[N]		[N]			[]		
RECOMMEN	(ACI	ľIC	ONS	3:		(If	đ	Ĺfſ	er	ent	: 1	Ero	om	NAS	A)									
	[3	/1	LR]		[P]		[P]		[P]		(AD		DE		TE)	
* CIL RE		1T]	101	I F	RAT:	IONA	LI	Ξ:	(I	fa	PE) 1:	ica			AI IAI	EQI	UAT: UAT:	E E	[]		
IOA FAIL MODE: PI THE SW C REDUNDAN AND REQU FAILS ON WHEN IN THE MISS	URE TON CONT ICY VIRE I, T	TAC MA ES THE	CSS Ana Th Ere C (FA FA AGE HE E I (OF	BI ILU MEI "AI S I	SW URES NT (ND" NO M 2/8)	CO RN OI (A)	ARE (1). F I TH	TAC TWO L IE	T-I AND SW CO OVE SWI	ILE RN NT RE	TEI ED I I TAC RII CH	RNA BY DES CTS DE CA	AL S Y TH SELE S FO CAP AN B	HC E CI R AE	RT ST S AN BII DE	ANI FII OI IT	DARI RST UTP Y. LEC'	D 3 FA UT.	CAIL	ON ED IF	TAC C:	CT : ONT SS :	ACT

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	GNC-160F	NASA DATA: BASELINE NEW	
SUBSYSTEM: MDAC ID: ITEM:	GNC 160 SWITCH- P, R/Y, C	CSS/AUTO	
LEAD ANALYST:	ROBERT O'DONNELL		
ASSESSMENT:	• . *		
CRITICAL FLIGH HDW/FU	T	CY SCREENS B C	CIL ITEM
·] [NA] [] [P] [NA] [NA] P] [P]	[] *
COMPARE [/N] [N][и] [и]	[]
RECOMMENDATIONS:	(If different :	P] [P]	[]
	, , , , ,	(A)	DD/DELETE)
	RATIONALE: (If ap	plicable) ADEQUATE INADEQUATE	
MODE: ROLL/YAW A	UTO PBI SW CONT-I	FAILS CLOSED. FMEA NTERNAL SHORT. ED BY THE STANDARD	

THE SW CONTACT FAILURES ARE HANDLED BY THE STANDARD 3 CONTACT SW REDUNDANCY MANAGEMENT (RM). SW RM DESELECTS FIRST FAILED CONTACT AND REQUIRES THE "AND" OF TWO CONTACTS FOR AN OUTPUT. IF AUTO PBI SW FLS ON, THE CREW WILL BE REQUIRED TO DEPRESS AND HOLD CSS PBI FOR MANUAL CNTL. IN ORBIT (OPS 2/8), THE SW CAN BE DESELECTED FROM RM. NO AUTOLAND CONSIDERED. THIS FAILURE WILL CAUSE A CHANGE IN OPERATING PROCEDURE AND INCREASE IN WORKLOAD.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/23/87 GNC-160 05-1-FC	G 7249-000)2	NASA DATA BASELINE NEW	
SUBSYSTEM: MDAC ID: ITEM:	GNC 160 SWITCH-	P, R/Y,	CSS/AUTO		
LEAD ANALYST:	ROBERT	o'donnei	ъ		
ASSESSMENT:					
CRITICAL: FLIGHT		REDUNDA	NCY SCREE	NS	CIL
	4C	A	В	c	ITEM
NASA [3 /3 IOA [3 /1R] [NA] P]	[NA] [P]	[NA] [P]	[] *
COMPARE [/N] [n]	[и]	[и]	[]
RECOMMENDATIONS:	(If d	ifferent	from NAS	A)	
[3 /1R] [P]	[P]		[] .DD/DELETE)
* CIL RETENTION F	LIANOITAS	E: (If a	,	ADEQUATE	
REMARKS: IOA FAILURE MODE: MODE: ROLL/YAW CS THE SW CONTACT FA REDUNDANCY MANAGE AND REQUIRES THE	S PBI SV LILURES A EMENT (RA	N CONT-I ARE HAND 1). SW	FAILS CLO NTERNAL SH LED BY THE RM DESELEO	OSED. FMEA HORT. E STANDARD CTS FIRST F	FAILURE 3 CONTACT SW AILED CONTACT
FAILS ON, THERE I WHEN IN ORBIT (OF THE MISSION CAN E	S NO MAN S 2/8),	WAL OVE THE SWI	RRIDE CAPA TCH CAN BE	ABILITY. DESELECTE	D FROM RM.

GNC-161	BASELINE	NASA DATA: BASELINE [] NEW [X]							
GNC 161 SWITCH- P, R/Y	(, CSS/AUTO								
ROBERT O'DONNE	ELL								
r	DANCY SCREENS B C	CIL ITEM							
] [NA]] [P]	[NA] [NA] [P] [P]	[] *							
] [N]	[и] [и]	[]							
(If differen	nt from NASA)								
] [P]	[P] [P] (A	[] DD/DELETE)							
RATIONALE: (If	applicable) ADEQUATE INADEQUATE	[]							
	GNC 161 SWITCH- P, R/Y ROBERT O'DONNE TY REDUNI TO A [NA] [P] [N] (If different	GNC-161 05-1-FC7245-0001 GNC 161 SWITCH- P, R/Y, CSS/AUTO ROBERT O'DONNELL TY REDUNDANCY SCREENS NC A B C [NA] [NA] [NA] [P] [P] [P] [IN] [N] [N] (If different from NASA) [P] [P] [P] (ARATIONALE: (If applicable) ADEQUATE							

IOA FAILURE MODE: SWITCH CONTACT FAILS OPEN. FMEA FAILURE MODE: PITCH AUTO PBI SW FAILS TO TRANSFER. IF AUTO PBI FAILS OFF, THE OTHER CREW POSITION CAN BE USED. FCS IS INITIALIZED IN AUTO DURING ASCENT. IF NECESSARY, CSS CAN BE FLOWN DURING ASCENT. CSS MANUAL MODE CAN BE FLOWN DURING ALL ENTRY PHASES. NO AUTOLAND IS CONSIDERED AT THIS TIME.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/23/87 GNC-161A 05-1-FC7246	GNC-161A BASELINE 05-1-FC7246-0001 NEW									
SUBSYSTEM: MDAC ID: ITEM:	GNC 161 SWITCH- P,	R/Y, CSS/AUTO									
LEAD ANALYST:	ROBERT O'DO	ONNELL.									
ASSESSMENT:											
CRITICAL FLIGH HDW/FU	T	OUNDANCY SCREENS	s c	CIL ITEM							
·		_									
NASA [3 /3 IOA [3 /1R] [NA]] [P]	[NA] [[P] [NA] P]	[] *							
COMPARE [/N] [N]	[N]	N]	[]							
RECOMMENDATIONS:	(If diffe	erent from NASA)									
[3 /1R] [P]	[P] [[] DD/DELETE)							
* CIL RETENTION	RATIONALE: (If applicable)									
		IN	ADEQUATE IADEQUATE	[]							
REMARKS: IOA FAILURE MODE: SWITCH CONTACT FAILS OPEN. FMEA FAILURE MODE: PITCH CSS PBI SW FAILS TO TRANSFER. IF CSS PBI SW FAILS OFF, USE THE OTHER CREW POSITION OR PLACE THE RHC OUT-OF-DETENT FOR MANUAL FCS CONTROL. NO AUTOLAND IS											
CONSIDERED AT TH	IS TIME.										

ASSESSME ASSESSME NASA FME	NT	II):	GNC-1	NC-161B 5-1-FC7248-0001								NASA DATA: BASELINE [] NEW [X]						
SUBSYSTE MDAC ID: ITEM:	M:			GNC 161 SWITC	:H-	Ρ,	R/Y	,	CS	S/AUT	0								
LEAD ANA	LYS	ST	;	ROBER	RT C) ' C	ONNE	LL											
ASSESSME	NT	:																	
	CR:		[CAL]	CTY C		RE	DUNE	AN	CY	SCRE	ENS	3			CIL				
	1	HDV	/FUI	1C		A			В			С							
NASA IOA	[3	/3 /1R]	[NA P	\]	[N. P	A]	[N? P	A]		[]	*		
COMPARE	[/N]	[N]	[N]	[N	1		[]			
RECOMMEN	IDA!	ri	ons:	(11	f di	iff	erer	ıt	fr	om NA	SA)							
	[3	/1R	1	[P]	[P]	[P] (2	A D!	[D/D	EL!	ETE)		
* CIL RE		NT:	ION 1	RATIO	ILAN	Ξ:	(If	ap	pl	icabl			DEQUATE DEQUATE		[[]			
DEMARKS:																			

IOA FAILURE MODE: SWITCH CONTACT FAILS OPEN. FMEA FAILURE MODE: ROLL/YAW AUTO PBI SW FAILS TO TRANSFER. IF AUTO PBI FAILS OFF, THE OTHER CREW POSITION CAN BE USED. FCS IS INITIALIZED IN AUTO DURING ASCENT. CSS MANUAL MODE CAN BE FLOWN DURING ALL ENTRY PHASES. NO AUTOLAND IS CONSIDERED AT THIS TIME.

ASSESSMI ASSESSMI NASA FMI	ENT ENT	D #:	ATE: D:	1/23 GNC- 05-1	GNC-161C BASELIN 05-1-FC7249-0001 NE]	
SUBSYSTE MDAC ID:				GNC 161 SWIT	CH-	P	, 1	R/Y,	CS:	S/A	UTO					
LEAD ANA	LY	ST	:	ROBE	RT	ויכ	001	NNELL								
ASSESSME	NT	:														
CRITICALITY REDUNDANCY SCREENS FLIGHT												CIL ITEM				
	,	HD	W/FU	NC		A			В			С				
NASA IOA	[3 3	/3 /1R]	[NA] [NA] [NA] [P]									[]	*
COMPARE	[/N]	[N]	[N]	[N]	[]	
RECOMMEN	DA'	TI(ons:	(I	f di	Ĺf1	fer	rent :	fro	om I	NASA)				
	(3	/1R]	[P]	[P]	ſ	P	•	[DD/D	•	ETE)
* CIL RE	TE	NT:	ION I	RATIO	NALI	2:	()	If app) 1:	ica!	ble)					
											I		DEQUATE DEQUATE	[]	
REMARKS: IOA FAILURE MODE: SWITCH CONTACT FAILS OPEN. FMEA FAILURE MODE: ROLL/YAW CSS PBI SW FAILS TO TRANSFER. IF CSS PBI SW FAILS OFF, USE THE OTHER CREW POSITION OR PLACE THE RHC OUT-OF-DETENT FOR MANUAL FCS CONTROL. NO AUTOLAND IS																
CONSIDER	ED	A'	r TH	IS TI	ME.											

ASSESSME ASSESSME NASA FME	:NT	II):	GNC	-20	1	14	2-2	2							SA Base	LIN	ΙE]		
SUBSYSTE MDAC ID:				GNC 201 THC	L																	
LEAD ANA	LYS	ST:	:	TRA	HAN	,	W.	H	•													
ASSESSME	ENT	:																				
	CR		ICAL:				RE	DUI	ND	AN	CY	sc	REE	NS	3				CII			
	I		W/FUI				A				В				С							
NASA IOA	[3	/1R /1R]]	P P]		[P P]		[[P P]			[]	*	
COMPARE	[/]		[]		[]		[]			[]		
RECOMME	NDA!	rI	ons:		(If	đ:	ifí	fer	en	t	fr	om	NAS	A))							
	[/]		[]		[]		[]		(A)	[DD/1	DEL	ETE)
* CIL R	ETE!	NT:	ION :	RAT:	IONA	L	Ε:	(I	f	ap	pl:	ica	able		A IAN	DEQU DEQU	JAT: JAT:	E E	[]		
REMARKS IOA FAI FMEA FA FAILURE NO DIFF	LUR ILU -OP	RE EN	MOD.	: L	oss Loss	0	F (ONE A	C CH	HA AN	NN NE	EL. L-7	TRAN									

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	3/20/87 GNC-202 05-1-FC	3142-1		NASA DA' BASELII NI	ra: NE [] EW [X]
SUBSYSTEM: MDAC ID:	GNC 202 THC				
LEAD ANALYST:	TRAHAN,	W. H.			
ASSESSMENT:					
CRITICAL FLIGH HDW/FU	T	REDUNI A	DANCY SCR	EENS C	CIL ITEM
NASA [2 /1R IOA [2 /1R] [P] P]	[P] [P]	[P] [P]	[X] * [X]
COMPARE [/] [1	[]	[]	[]
RECOMMENDATIONS:	(If di	lfferen	nt from N	ASA)	
[/] [J	[]	[]	[] ADD/DELETE)
* CIL RETENTION	RATIONALE	E: (If	applicab:	le) ADEQUATE INADEQUATE	[x]
REMARKS: IOA FAILURE MODE FMEA FAILURE MODE NO DIFFERENCES.					

ASSESSMEN ASSESSMEN NASA FMEA		_			314	2-3	NASA DATA BASELINE NEW							-			
SUBSYSTEM MDAC ID: ITEM:	1 :		GNC 203 THC														
LEAD ANA	LYST	:	TRAHAN	ī,	W.	н.											
ASSESSME	NT:																
(ICAL	ITY r		RE	DUNDA	N	CY	SCREE	NS	;		CI				
		W/FUI			A			В			С						
NASA IOA	[3 [2	/1R /1R]	[P P]	[P P]]	P P]	[X] *		
COMPARE	[N	/	1	[]	[]	[]	[N]		
RECOMMEN	DATI	ons:	(If	d :	Ĺff	erent	: 1	fro	om NAS	SA)							
	[/	3	[]	[]	[] (A)	[DD/] LETE)		
* CIL RE	PENT:	ION 1	RATION	ALI	Ξ:	(If a	ıpı	pli	icable	e) IN	AI IAI	EQUATE EQUATE	[]		
REMARKS: IOA FAIL FMEA FAI MANUAL E ADDITION CRITICAL	LURE I SE AL I	MOD: P REC OA A	E: ERRO QUIRES NALYSIS	ONI A S (EOU MA OF	IS OUT ANUAL- THIS	PI Z F	TI TI AII	RANSLA LURE N	TI 101	ION DE	I MANEUV CHANGED	ER. TH	E	HARDWARE		

ASSESSME ASSESSME NASA FME	TY	I	D:	GNC-3	01	34	42-1						ASA DA BASELI N		[) x]	
SUBSYSTE MDAC ID:	M:			GNC 301 RPTA													
LEAD ANA	LYS	ST	:	LES D	RA:	PE:	LA										
ASSESSME	NT:	:															
	CR		ICAL:	I TY r		RI	EDUN	DANC	Y:	SCR	EEN	S			CII		
	I		/FUI	_		A			В			С			111	21-1	
NASA IOA	[3 3	/1R /1R]	[P P]	[P P]	[P P]		[]	*
COMPARE	[/]	[]	[]	[]		[]	
RECOMMEN	DA'I	ric	ons:	(If	d .	if	fere	nt f	r	om N	ASA)					
	[/]	[]	[]	[(AI	[DD/I) EL	ETE)
* CIL RE	TEN	T	ION I	RATION	ALI	E:	(If	app	11	icab	,	IA IAN	DEQUAT	E E	[]	
IOA FAIL FMEA FAI			_									-	•				

NO DIFFERENCES.

ASSESSMENT DATE: 1/23/87 ASSESSMENT ID: GNC-302 NASA FMEA #: 05-1-FC3442-2													DA EĹI N	NE		x :]					
SUBSYSTE MDAC ID:				GNC 302 RPT	02																	
LEAD ANA	LY	ST	:	LES	DRA	٩F	EI	LA.														
ASSESSMENT:																						
CRITICALITY REDUNDANCY S FLIGHT								SC	REE	NS	3				C]	L CEM						
]		/FU				A				В				С							
NASA IOA	[3	/1R /1R]		[[P P]]	P P]		[P P]			[:]	*
COMPARE	[/]		[]		[]		[]			[]	
RECOMMEN	IDA'	ri	ons:	(:	[f (i£	Ĺfi	fere	ent	f	r	om :	NAS	A))							
	[/	1 .		[]		[]		[]		(A		/DE		TE)
* CIL RE	TE	NT:	ION I	RATIO	ONA:	LE	Ξ:	(If	ŧ a	pr	1:	ica	bl∈			_	UAT UAT		[]	
FMEA FAI	REMARKS: IOA FAILURE MODE: ERRONEOUS OUTPUT ON ONE CHANNEL. FMEA FAILURE MODE: ERRONEOUS OUTPUT. NO DIFFERENCES.																					

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/23/8 GNC-303 NONE			NASA DATA BASELINE NEW	[]
MDAC ID:	GNC 303 RPTA				
LEAD ANALYST:	LES DRA	PELA			
ASSESSMENT:					
CRITICAL FLIGH		REDUNDA	NCY SCREI	ens	CIL ITEM
HDW/FU		A	В	C	*****
NASA [/ IOA [3 /1R] [P]	[] [P]	[] [P]	[] *
COMPARE [N /N] [и]	[N]	[N]	[]
RECOMMENDATIONS:	(If d	ifferent	from NAS	SA)	
[3 /1R] [P]	[P]	[P] (AI	[] DD/DELETE)
* CIL RETENTION	RATIONAL	E: (If a	pplicable	≥) ADEQUATE INADEQUATE	[]
REMARKS: IOA FAILURE MODE NASA/RI DID NOT (FMEA BEING WRITT)	COVER TH	IS FAILU	RE MODE.	ONE CHANNEL.	

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/23/86 GNC-304 05-1-FC3	442-3		NASA DATA: BASELINE NEW	
SUBSYSTEM:	GNC 304 RPTA				
LEAD ANALYST:	LES DRAF	PELA			
ASSESSMENT:					
CRITICAL: FLIGH	CIL ITEM				
HDW/FU	NC	A	В	С	
NASA [1 /1 IOA [2 /1R] [NA] [P] [NA] [P] [NA] P]	[X] *
COMPARE [N /N] [N] [и] [N]	[]
RECOMMENDATIONS:	(If di	ifferent f	rom NASA)		
[/] [] [] [[DD/DELETE)
* CIL RETENTION	RATIONALI	E: (If app		ADEQUATE NADEQUATE	
REMARKS: IOA FAILURE MODE FMEA FAILURE MOD LINKAGE FAILURE AFTER DISCUSSION THE NASA CRITICA SEPARATELY BUT A TWO SELECTED SIG THE JAMMED RPTA SIGNAL FROM THE	E: PHYSICS WITH NALITY. SINALS IS COULD BE	CAL JAMMIN ASA AND FU INCE RM IS ME TIME AN CHOSEN AS SELECTED,	IG OF TRAN URTHER AND S PERFORMS ID THEN THE THE COMMA	ALYSIS, IOA ED ON EACH HE LARGEST AND, THE SI	IVE OR A AGREES WITH RPTA VALUE OF THE IGNAL FROM

ASSESSMENT DASSESSMENT INASA FMEA #:	D: GNC-4			NASA DA BASELI N							
SUBSYSTEM: MDAC ID: ITEM:	GNC 401 SBTC										
LEAD ANALYST: ROBERT O'DONNELL											
ASSESSMENT:											
	ICALITY LIGHT	REDUNI	DANCY SCR	EENS	CIL ITEM						
	/FUNC	A	IIIM								
NASA [2 IOA [2	/1R] /1R]	[P] [P]	[P] [P]	[P] [P]	[X] * [X]						
COMPARE [/ 1	[]	[]	[]	[]						
RECOMMENDATIO	ONS: (If	differer	nt from N	ASA)							
[/ 1	[]	[]	[]	[] (ADD/DELETE)						
* CIL RETENTION RATIONALE: (If applicable) ADEQUATE [X] INADEQUATE []											
FMEA FAILURE	REMARKS: IOA FAILURE MODE: PHYSICAL BINDING/JAMMING OF CNTL LEVER. FMEA FAILURE MODE: PHYSICAL JAMMING. NO DIFFERENCES.										

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	GNC-402	242-2		NASA DATA BASELINE NEW						
SUBSYSTEM: MDAC ID: ITEM:	GNC 402 SBTC									
LEAD ANALYST:	ALYST: ROBERT O'DONNELL									
ASSESSMENT:										
CRITICAI FLIG	CIL ITEM									
HDW/FU		A	В	С	· •					
NASA [3 /1F IOA [3 /1F	[[P] P]	[P] [P]	[P] [P]	[] *					
COMPARE [/] []	[]	[]	[]					
RECOMMENDATIONS	(If di	fferent	from NA	SA)						
[/] [1	[]	[] (A	[] DD/DELETE)					
* CIL RETENTION	RATIONALE	: (If a	pplicable							
				ADEQUATE INADEQUATE	[]					
REMARKS: IOA FAILURE MODE: NO TRANSDUCER OUTPUT ON A CMD CHANNEL. FMEA FAILURE MODE: LOSS OF A CHANNEL-TRANSDUCER. NO DIFFERENCES. REFERENCE MDAC ID 404 REMARKS. RECOMMEND CHANGE TO FMEA FAILURE MODE: LOSS OF A CHANNEL - TRANSDUCER OR SWITCH.										

ASSESSMENT DATE: 1/23/87 ASSESSMENT ID: GNC-403 NASA FMEA #: 05-1-FC3242-3										ASA DA BASELI N	NE	_]				
SUBSYSTE MDAC ID:				GNC 403 SBTC													
LEAD ANA	LY	ST	:	ROBER	r (0'1	DONNE	ELI									
ASSESSME	NT	:															
		F	ICAL: LIGH: W/FUI	-		RI A	EDUNI	AN	ICY E		REEN	s C			CIL		
NASA IOA	[3	/1R /1R]	[P P]	[F)]	[P P]		[]	*
COMPARE	[/	1	[]	[]	[]		[]	
RECOMMEN	DA:	ΓI	ONS:	(If	d:	if	feren	ıt	fr	om	NASA))					
	(/]	[]	[]	[]		[DD/D		ETE)
* CIL RE	TEI	NT:	ION I	RATIONA	ΙLI	Ε:	(If	ap	pl	ica	•		DEQUAT DEQUAT		[]	
REMARKS: IOA FAIL FMEA FAI NO DIFFE	LUI	RE	MODI														

REFERENCE MDAC ID 405 REMARKS. RECOMMEND CHANGE TO FMEA FAILURE MODE: ERRONEOUS OUTPUT - TRANSDUCER OR SWITCH CHANNEL.

ASSESSME ASSESSME NASA FME	NT	II):	GNC-	-40										DATA: LINE NEW]		
SUBSYSTE MDAC ID: ITEM:					2														
LEAD ANA	LYS	ST	:	ROBI	ERT	0	' D	юии	ELL										
ASSESSME	NT:	:																	
CRITICALITY FLIGHT HDW/FUNC									DAN	CY B	SC	REEN	rs C			CIL			
NASA IOA	[3	/ /1R]		[P]	[P]	(P]		[]	*	
COMPARE	Į.	N	/N]		[N]	[N]	ſ	N]		[]		
RECOMMEN	IDA!	ΓΙ	ons:	(:	Ιf	di	ff	ere	nt :	fro	om I	NAS <i>I</i>	۲)						
	[/]		[]	[]	i		1	(Al	[(D/D		ETE)	
* CIL RE	ETE	NT:	ION :	RATI(ONA	LE	:	(If	ap	pl:	ica	ble)	A AN	DEQU DEQU	JATE JATE	[]		
REMARKS: IOA FAII FMEA FAI NASA/RI SW CHN). FC3242-2 CHANGED NO NEW I	LUR LUI DII TO TO	RE D 1 IO CR H	MOD NOT A RE ITIC LOSS RECO	E: NO COVE	ONE R T END Y 3 A C DED	HI S /1 HA	S TH R N	FAI HIS . I NEL INCE	LUR FAI HE - T	E I LU! PR! RA! E (MOD RE ESE NSD CRI	E (1 MODI NT 1 UCEI TICI	NO E B FAI R C	OUTI E AI LURI R SV	PUT OF THE	ro fi E co ". Is fi	MEA ULI AII	A 05-1 D BE LURE	

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	GNC-405			NASA DATA BASELINE NEW]
	GNC 405 SBTC					
LEAD ANALYST:	ROBERT	O'DONNEL	L			
ASSESSMENT:						
FLIGH'	T	REDUNDA	NCY SCREENS		CIL	
HDW/FU	NC	A	В	С	,	
NASA [/ IOA [3 /1R] [P]	[] [[P]	P]	[] *
COMPARE [N /N] [N]	[и]	и ј	[]
RECOMMENDATIONS:	(If d	ifferent	from NASA)			
[/] []] [[DD/DE] ELETE)
* CIL RETENTION I	RATIONAL	E: (If ag		ADEQUATE	ſ	1
REMARKS:			IN	ADEQUATE ADEQUATE	į	j
IOA FAILURE MODE: FMEA FAILURE MODE		ER SW CHI	V FAILS ON.			
NASA/RI DID NOT (ON).		IS FAILUF	RE MODE (TA	KEOVER SW	CHN	FAILS
IOA RECOMMENDS THE CRITICALITY 3/1R. "ERRONEOUS OUTPUT	. THE PI I-TRANSDU	RESENT FA	AILURE MODE SWITCH CHAN	COULD BE	CHAN	GED TO
NO NEW FMEA RECOMMODE DOES NOT INC	MMENDED, CREASE TH	SINCE THE	HE CRITICAL ING CRITICA	ITY OF THI LITY OF TH	S FA	ILURE EM.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/23/87 GNC-406X 05-1-FC32	242-4				SA DATA: ASELINE NEW	[
SUBSYSTEM:	GNC 406 SBTC							
LEAD ANALYST:	ROBERT O	'DONNEL	L					
ASSESSMENT:								
CRITICAL FLIGH	mr ·	REDUNDA	NCY	SCREE	NS		CII	
HDW/FU	NC .	A	В		С			
NASA [2 /1R IOA [2 /1R] [P] P]	[P [P]	[P]	[]	(] * (]
COMPARE [/] [1	C]	[1	[]
RECOMMENDATIONS:	(If di	fferent	fro	om NAS	A)			
[/] [)	Ĺ]	[] (A] DELETE)
* CIL RETENTION	RATIONALE	: (If a	appl:	icable	Al	DEQUATE DEQUATE		x]
REMARKS: IOA FAILURE MODE FMEA FAILURE MODE NO DIFFERENCES. THE IOA DID NOT DID COVER TAKEOU NO OUTPUT ON A TOA IOA ANALYSIS WAS (ID-406) PROVIDE	COVER THIVER SW CHNORMERS SERVINGER SW CHNORMERS SERVINGER SERVING	CAL JAI S ITEM I FAILS SW CHN	MMING IN (ON (ASS) AN A	G OF M THE OF (ASSES ESSMEN NALYS)	RIGII SSMEI VT II	NAL ANAL NT ID GN D GNC-40 ORKSHEET	YSI C-4 4).	S. IOA 05), AND A NEW

ASSESSMENT ASSESSMENT NASA FMEA	r date r id: #:	: 1/23 GNC- 05-1	3/87 -410 FC72	251-0	0001	NASA D BASEL		
SUBSYSTEM: MDAC ID: ITEM:		GNC 410 SWIT	CH-SI	PD BH	K/THROT PBI	:		
LEAD ANALY		ROBE	RT O	DONN	IELL			
CR	RITICA FLIG	LITY HT UNC		REDUN	DANCY SCRE	EENS C	CII ITE	
] ASAN] AOI	3 /3 3 /2] R]	[N [P	[A]	[NA] [P]	[NA] [P]	[] *]
COMPARE [/N]	[N]	[N]	[и]	[]
RECOMMENDA	TIONS	: (I	f dif	fere	nt from NA	SA)		
[/]	[]	[]	[]	(ADD/D	-
* CIL RETE	NTION	RATIO	NALE:	(If	applicable	e) ADEQUAT INADEQUAT	E []
IOA FAILUR FMEA FAILU STATE. DOWNGRADE : NORMALLY II BY THE SBT	RE MOI SPD BI N AUTO C TAKE	OE: FAI C/THRO! OUNLES	ILS T F PBI SS SY: SWITC	O TR AUTO STEM	ANSFER-SWIT O SWITCH TO FAILURE RI ONCE IN MAI	TCH WILL N CRIT 3/3 EQUIRES MA	. SYST	FEM AKEOVER
REMAIN IN S LOAD. THE MODE. IOA DOES CO	SBTC N	TAKEO	CONT VER SI	ROL 1 W MU:	MODE WITH S ST BE HELD	SOME INCRE IN TO MAI	ASE IN NTAIN I	WODV

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/23/87 GNC-4107 05-1-FC	./23/87 NASA DATA ENC-410A BASELINE 05-1-FC7251-0002 NEW								
	GNC 410 SWITCH-S	10 WITCH-SPD BK/THROT PBI								
LEAD ANALYST:	ROBERT (O'DONNEL	L							
ASSESSMENT:										
CRITICAL FLIGH		REDUNDA	NCY SCREE	NS	CIL					
HDW/FU		A	В	С						
NASA [3 /3 IOA [3 /2R] [NA] P]	[NA] [P]	[NA] [P]	[] *				
COMPARE [/N] [N]	[и]	[N]	[]				
RECOMMENDATIONS:	(If d	ifferent	from NAS	A)						
[/] [3	[]	[] (A)	-] ELETE)				
* CIL RETENTION	RATIONAL	E: (If a	pplicable) ADEQUATE INADEQUATE	[]				
REMARKS: IOA FAILURE MODE: SWITCH CONTACT FAILS CLOSED. FMEA FAILURE MODE: INTERNAL SHORTS. DOWNGRADE SPD BK/THROT PBI AUTO SWITCH TO CRIT 3/3. SYSTEM NORMALLY IN AUTO UNLESS SYSTEM FAILURE REQUIRES MANUAL TAKEOVER BY THE SBTC TAKEOVER SWITCH. ONCE IN MANUAL MODE, CREW CAN REMAIN IN SBTC MANUAL CONTROL MODE WITH SOME INCREASE IN WORK LOAD. THE SBTC TAKEOVER SW MUST BE HELD IN TO MAINTAIN MANUAL MODE. TOA DOES CONCUR WITH NASAS REEVALUATION AND RATIONALE.										

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/23/87 GNC-411 05-1-FC7	7251-0001		NASA DATA BASELINE NEW							
SUBSYSTEM: MDAC ID: ITEM:	GNC 411 SWITCH-S										
LEAD ANALYST:	ROBERT O	'DONNELL									
ASSESSMENT:											
FLIGH	ITY T NC		CY SCREEN B		CIL ITEM						
NASA [3 /3 IOA [3 /1R] [NA] [P] [NA] [P] [NA] P]	[] *						
COMPARE [/N] [и ј [и ј [N]	[]						
RECOMMENDATIONS:	(If di	fferent i	from NASA)							
[/] [] [] [] (A)	[] DD/DELETE)						
* CIL RETENTION :	RATIONALE	: (If app	•	ADEQUATE NADEQUATE							
IOA FAILURE MODE: SWITCH CONTACT OR CURRENT LIMIT RESISTOR FAILS OPEN OR SHORTED TO GROUND. FMEA FAILURE MODE: FAILS TO TRANSFER-SW WILL NOT CHANGE STATE. DOWNGRADE SPD BK/THROT PBI AUTO SWITCH TO CRIT 3/3. SYSTEM											
BY THE SBTC TAKES REMAIN IN SBTC M. LOAD.											
OA DOES CONCUR WITH NASAS REEVALUATION AND RATIONALE.											

ASSESSME																	ELI	TA: NE IEW	[]	
SUBSYSTEM MDAC ID:	M:			GNC 501 IMU																		
LEAD ANA	LYS	ST:		J.M	. HI	O	ГТ	•														
ASSESSME	NT:	:																				
	CRITICALITY REDU									NC	Y	sc	CREE	NS	3					IL PEN	1	
	FLIGHT HDW/FUNC A										В				С				-			
NASA IOA	[2	/1R /1R]	[}		P P]] [P P]		[F F]			[X X]	*
COMPARE	[/]	[]		[]		[]			[]	
RECOMMEN	'DA'	rI	ONS:	(If d	li	fí	fere	ent	: 1	fro	om	NAS	A)							
	[/]	1	•]		[]		[]		(A		/ D1		ETE)
* CIL RE	TE	NT:	ION	RATI	ONA]	LΕ	:	(II	f a	ıpı	pl:	ica	able			-		TE TE		x]	
REMARKS: IOA FAII FMEA FAI NO DIFFE	UR LU	RE	MOD	: ER E: E	RONI RROI	EO NE	U: JO:	JO S	TTU	יטי יפי	r. UT	•										

ASSESSMENT ASSESSMENT NASA FMEA	ID:	3/20/87 GNC-502 05-1-GN		1					ASA D. BASEL		[x]	
SUBSYSTEM: MDAC ID: ITEM:		GNC 502 IMU												
LEAD ANALY	ST:	J.M. HI	отт											
ASSESSMENT	:													
CR	ITICALI FLIGHT		REI	OUNDAN	CY	SCREE	ENS	3			CI		1	
. 1	HDW/FUN	1C	A		В			С					-	
NASA [IOA [3 /1R 3 /1R] [P P] [P P]]	F F]		[X X]	*
COMPARE [/] [] []	[]		[]	
RECOMMENDA	rions:	(If d	iffe	erent :	fro	m NAS	A)							
[/] []	[]	[]	(AD	[D/] ¦LE	TE)
* CIL RETER					pli		-		EQUAT		[:]	
IOA FAILURI FMEA FAILUR					,									

NO DIFFERENCES.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	3/20/87 GNC-510 05-60-200	0201-1		BASELINE NEW	
SUBSYSTEM: MDAC ID: ITEM:	GNC 510 IMU POWEI	R CIRCUIT			
LEAD ANALYST:	J.M. HIO	ГT			•
ASSESSMENT:					
CRITICA FLIG	LITY 1 IT	REDUNDANC	CY SCREENS	*	CIL ITEM
HDW/FU	INC I	A	В	С	
NASA [3 /11 IOA [3 /11	R] []	P] [P] [F] [P] [P] P]	[X] *
COMPARE [/] [] [и][1	[N]
RECOMMENDATIONS	(If di	fferent i	from NASA)	
[/] [] [] [[*] DD/DELETE)
* CIL RETENTION	RATIONALE	: (If app	plicable) I	ADEQUATE NADEQUATE	
REMARKS: IOA FAILURE MODE FMEA FAILURE MODE FIRST FAILURE UP THE SECOND FALI OUTPUT FROM THI BECAUSE THE WOR RECOMMENDS ADDI THIS IS A CIL I * DISPOSITION ASSESSMENT.	DE: FAIL O NDETECTED URE ON THE S IMU WILL ST CASE (2 TIONAL CON TEM.	PEN, FAII BUT CURRI SAME IMU BE DISCA FAILURES	L TO CONDI ENT STILL U IS DETE ARDED AND S) PASSES ON BE GIV	UCT (DIODE CONDUCTED CTED IN FL ANNUNCIAT ALL SCREE EN AS TO W	TO THE IMU. IGHT. THE ED BY RM. NS, IOA EATHER OR NOT

ASSESSME ASSESSME NASA FME	NT NT A	D. I:	ATE: D:	3/20/ GNC-5 05-60	87 10 -I	A MU	(03)						ASA DAT BASELIN NE	1E				
SUBSYSTE MDAC ID:	M:			GNC 510 IMU P														
LEAD ANA	LY	ST	:	W.H.	TR	AH	AN											
ASSESSME	NT:	:																
	CR		ICAL: LIGH	ITY		R	EDUNDA	YNC.	Y	SCREE	EN:	S			CII			
	I			NC		A		1	В			С			ITI	SM.		
NASA IOA]	3 3	/1R /1R]	[P P]	[]	P P]	[P P]		[]	*	
COMPARE	[/]	[]	[]	[]		[]		
RECOMMEN	DAT	ric	ONS:	(If	đ:	if	ferent	: fi	ro	m NAS	A))						
	[/]	[]	[]	[[D/[ETE)
* CIL RE	TEN	(TV	ON I	RATION	ALI	Ξ:	(If a	lpp]	lί	.cable	-	ΑI	DEQUATE		[]		
REMARKS:													DEQUATE DEQUATE		Ĺ	j		
IOA FAILI FMEA FAII NO ACTIO	LUF	₹E	MODE	E: OPEN	١,	SF	HORT,	ניטס	r–	OF-TO	LE	LI ERA	ED OPEN ANCE (R	ES	ISI	'OR	S).	

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	GNC-510E			NASA DATA: BASELINE NEW							
	GNC 510 IMU POWE	ER CIRCU	JIT								
LEAD ANALYST:	W.H. TRA	LHAN									
ASSESSMENT:											
CRITICALITY REDUNDANCY SCREENS CI FLIGHT IT											
HDW/FUNC A B C											
NASA [3 /1R IOA [3 /1R] [P] P]	[P] [P]	[P] [P]	[] *						
COMPARE [/] []	[]	[]	[]						
RECOMMENDATIONS:	(If d	ifferen	t from NAS	SA)							
[/] []	[]	[] (A	[] .DD/DELETE)						
* CIL RETENTION	RATIONAL	E: (If	applicablo	e) ADEQUATE INADEQUATE	[]						
REMARKS: IOA FAILURE MODE FMEA FAILURE MODE PREMATURE OPERAT NO ACTION REQUIR	E: LOSS (OF OUTP	UT, FAILS	FAILED OPEN. TO CONDUCT,							

ASSESSME ASSESSME NASA FME	ASSESSMENT DATE: 3/20/87 ASSESSMENT ID: GNC-511 NASA FMEA #: 05-60-200200- SUBSYSTEM: GNC												ASA DATA BASELINI NEV			
SUBSYSTE MDAC ID:	Μ:			GNC 511 IMU F												
LEAD ANA	LY	ST	:	J.M.	HI	OT:	r									
ASSESSME	NT	:														
FLIGHT												CI				
											IT	š m				
NASA IOA	/1R /1R	[P P]	[P P]	[P P]	[]	*			
COMPARE	NASA [3 /1R]]	[]	[)	
RECOMMEN	DAT	ric	ons:	(If	đi	Ĺf1	feren	t 1	fro	om NA	SA)	ļ				
	[/	1	[]	[]	[[.DD/I) DEL	ETE)
* CIL RE	TEN	T]	ON F	RATION	ALE	E:	(If a	app	oli	.cabl	e)			_		
REMARKS:											IN		EQUATE EQUATE]	
IOA FAIL FMEA FAI OFF.	LUF	Œ	MODE	: SWI	TCH		- OPEI	٧,	SH	ORTS	, F		L TO TR	ANSI	ER	FROM
NO ACTIO	N H	Œζ	MIXIO	10 - R	ESU	LI	'S ARI	<u>.</u>	'HE	SAM	Ε.					

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	3/20/87 GNC-512 05-60-20	0200-2		NASA DATA: BASELINE NEW]
MDAC ID:	GNC 512 IMU POWE	R CIRCUIT	•			
LEAD ANALYST:	J.M. HIO	TT				
ASSESSMENT:						
CRITICAL: FLIGH		CIL ITEM				
HDW/FU	NC .	A	В	С		
NASA [3 /3 IOA [3 /3] [NA] [NA] [NA] [NA]	[] *]
COMPARE [/] [] [] []	[]
RECOMMENDATIONS:	(If di	fferent f	from NASA	4)		
[/] [] [)	[] (A)	[DD/DE] LETE)
* CIL RETENTION	RATIONALE	: (If app		ADEQUATE INADEQUATE	[]
REMARKS: IOA FAILURE MODE FMEA FAILURE MOD OPERATIONS. NO ACTION REQUIR	E: SWITCH	CUIT FAII SHORT (G	LED CLOSI	ED.		MATURE

ASSESSMI ASSESSMI NASA FMI	ENT	I	D:	GN	/23, C-6 -1-	01		-1							ASA DA BASELI	INE		x]	
SUBSYSTI MDAC ID: ITEM:				GNG 60: ST		r.	AC:	KEF	₹										
LEAD ANA	LY	ST	:	LES	S DI	RA:	PE:	LA											
ASSESSME	ENT	:																	
	CRITICALITY REDUITED IN THE PROPERTY OF THE PR										Y	SCF	REEN				CII		
	3	HDI	W/FUI	NC			A				В			С					
NASA IOA	[3 3	/1R /1R]		[P P]		[P P]	[[P P]		[]	*
COMPARE	[/]		[]		[3	[]		[]	
RECOMMEN	IDA:	ric	ons:	((If	đ:	if	fer	ent	f	r	om N	IASA)					
	(/]		[]		[]	[]	(AI	[DD/E) ELI	ETE
* CIL RE									f a	pp	li	cab			DEQUAT DEQUAT		[]	
IOA FAIL									יוזמייי	T)									

NO DIFFERENCES.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/23/86 GNC-6012 05-1-GN2	A		NASA DATA BASELINI NE		-
	GNC 601 STAR TRA	ACKER				
LEAD ANALYST:	LES DRAI	PELA				
ASSESSMENT:						
CRITICAL		REDUND	ANCY SCRE	ENS	CIL	
FLIGH HDW/FU	_	A	В	С	1113	
NASA [3 /1R IOA [3 /1R] [P] P]	[P] [P]	[P] [P]	[] *
COMPARE [/] [3	[]	[]	[]
RECOMMENDATIONS:	(If d	ifferen	t from NA	ASA)		
[/] []	[]	[] ([ADD/D] ELETE)
* CIL RETENTION	RATIONAL	E: (If	applicabl	le) ADEQUATE INADEQUATE]
REMARKS: IOA FAILURE MODE FMEA FAILURE MOD NO DIFFERENCES.			HUTTER FA		_	-

	12/23/86 GNC-602 NONE			NASA DATA: BASELINE NEW	_]
MDAC ID:	GNC 602 STAR TRAC	CKER				
LEAD ANALYST:	LES DRAPE	ELA				
ASSESSMENT:						
CRITICALI FLIGHT	ITY R	REDUNDAI	NCY SCREE	NS	CIL ITEM	r
HDW/FU		1	В	С	IIII	•
NASA [/ IOA [3 /1R] [P]	[] [P]	[] [P]	[] *
COMPARE [N /N] [N	i) ([и]	[и]	[]
RECOMMENDATIONS:	(If dif	ferent	from NAS	A)		
[3 /1R] [P	'] [[P]	[P] (AD	[DD/DE] LETE)
* CIL RETENTION F	RATIONALE:	(If ag) ADEQUATE INADEQUATE	-]
REMARKS: IOA FAILURE MODE: NASA/RI DID NOT O FMEA BEING WRITTE	COVER THIS	FAILUE	JT. RE MODE.	-	-	END A

ASSESSME ASSESSME NASA FME	NT	II):	GNC-60			·2						ASA D BASEL		[]	
SUBSYSTE MDAC ID:				GNC 603 STAR T	'R <i>I</i>	CF	ŒR										
LEAD ANA	LYS	ST:	:	LES DF	IAS	EI	A										
ASSESSME	NT	:															
CRITICALITY REDUNDA FLIGHT HDW/FUNC A										SCI	REEN				CIL		
	I	HDV	/FUI	NC		A			В			С					
NASA IOA]	3	/1R /1R]	[P P]	[P P]]]	P P]		[]	*
COMPARE	[/]	(1	[]	[]		[]	
RECOMMEN	IDA'	ri	ons:	(If	d.	if:	feren	ıt	fr	om 1	NASA	.)					
	[/]	[)	(]	[3	(A	[DD/D		ETE)
* CIL RI	ETE:	NT:	ION	RATION	AL	E:	(If	aŗ	pl	ica		Α	DEQUA DEQUA		[]	
REMARKS: IOA FAII FMEA FAI NO DIFFI	LUR LLU	RE	MOD	: Loss E: Los	o s	F OF	INPUI JANI	r. JT.	•								

ASSESSM	SSESSMENT DATE: SSESSMENT ID: GNC-604X ASA FMEA #: 05-1-GN22-3 UBSYSTEM: GNC													A DA SELI	NE) X]	
SUBSYST				GNC 604 STAR	TR	AC	KER											
LEAD AN	ALY	ST	:	LES D	RA	PE:	LA											
ASSESSMI	ENT	:																
	CRITICALITY REDUN									SCREE	NS	3				CII	_	
	HDW/FUNC A											С				ITE	EM	
NASA IOA	[3	/1R /1R]	[P P]	[F	•]]	P P]			[]	*
COMPARE	[/]	[]	[]	[]			[]	
RECOMMEN	IDA:	ric	ONS:	(If	đ:	ifi	ferei	nt fr	.01	m NAS	A)							
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* CIL RE		YT)	ON I	RATION	ALI	Ξ:	(If	appl	i		•	AI AI)EÇ	UAT UAT	e e	[]	
IOA FAII FMEA FAI NO DIFFE	URI	RΕ	MODE	MECHAE: MECHAE	INA IAN	ICA	AL SE	UTTE HUTT	R EI	FAILS R FAI	s Ls	OF C	PEN	ı. N.				

	12/23/86 GNC-610 NONE			NASA DATA: BASELINE NEW]
	GNC 610 CIRCUIT-S	STAR TRA	CKER POWEI	R		
LEAD ANALYST:	LES DRAPE	ELA				
ASSESSMENT:						
CRITICAL FLIGH		REDUNDAN	CY SCREEN	S	CIL	ſ
HDW/FU		A	В	C	1111	
NASA [/ IOA [3 /3] [1] [AR] [NA] [NA]	[] *]
COMPARE [N /N] []	A] [N] [N]	[]
RECOMMENDATIONS:	(If di	fferent	from NASA)		
[3 /3] []	NA] [NA] [NA]	[DD/DI] ELETE)
* CIL RETENTION	RATIONALE	: (If ap		ADEQUATE NADEQUATE	[]
REMARKS: IOA FAILURE MODE NASA/RI DID NOT FMEA BEING WRITT	COVER THIS	S FAILUR	E MODE.	H FAILS CLO IOA DOES RI	OSED.	MEND A

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/23/86 GNC-611 05-60-20	2/23/86 NASA DATA: NC-611 BASELINE 5-60-200100-1 NEW								
00201012111	GNC 611 CIRCUIT-			POWER						
LEAD ANALYST:	LES DRAF	PELA								
ASSESSMENT:										
CRITICAL		REDUND	ANCY SCE	REENS	CIL					
FLIGHT HDW/FU		A	В	С	ITEM					
NASA [3 /1R IOA [3 /1R] [P] P]	[P] [P]	[P] [P]	[] *					
COMPARE [/] []	[]	[]	[]					
RECOMMENDATIONS:	(If di	fferen	t from N	IASA)						
[]] []	[]		[] (ADD/DELETE)					
* CIL RETENTION I	RATIONALE	: (If	applicab							
DEM DVG				ADEQUATI INADEQUATI] []					
REMARKS: IOA FAILURE MODE: FMEA FAILURE MODE PREMATURE POWER) NO DIFFERENCES.			MODES (LOSS OF OUT	PUT, SHORTS,					

ASSESSMEN ASSESSMEN NASA FMEA	m T	n .		2		L00 -	1						ASA DAT BASELIN NE	ΙE			
SUBSYSTEM MDAC ID:	[:		GNC 612 CIRCUI	12 IRCUIT-STAR TRACKER POWER													
LEAD ANAL	YST	:	LES DE	RAI	PEI	ĹΑ											
ASSESSMEN	T:																
C	F	LIGH'	ITY I NC		RI A	EDUN	[DA]	NC	Y B	sc	REENS	c C			CIL		
NASA IOA	[3 [3	/1R /1R]	[P P]		[P P]	[P P]		[]	*
COMPARE	[/]	[]		[]	[]		[]	
RECOMMEND	ATI	ONS:	(If	đ	if	fere	ent	f	ro	om	NASA)					
	[/]	[]		[]	ĺ]	(AI	[DD/D		ETE)
* CIL RET	ENT	ION :	RATION	AL	E:	(If	: a	pp	1 1	ica		A I A V	DEQUATI DEQUATI	2 2	[]	
REMARKS: IOA FAILU FMEA FAII PREMATURE NO DIFFEE	LURE PO	MOD WER)	: SWIT E: ALL	CH C	SI REI	HORT DIBI	rs Le	TC MC) (GRO ES	OUND.						RTS,

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/23/8 GNC-701 07-1-72	6 5101-3		NASA DATA BASELINE NEW	
SUBSYSTEM: MDAC ID:	GNC 701 COAS				
LEAD ANALYST:	LES DRA	PELA			
ASSESSMENT:					
FLIGHT	C		ANCY SCREI		CIL ITEM
HDW/FUN	NC	A	В	С	
NASA [3 /1R IOA [3 /3] [[] *			
COMPARE [/N] [и]	[N]	[и]	[]
RECOMMENDATIONS:	(If d	ifferent	from NAS	SA)	
['/] []	[]		[] .DD/DELETE)
* CIL RETENTION R	RATIONAL	E: (If a	applicable	e) ADEQUATE INADEQUATE	[]
REMARKS: IOA FAILURE MODE: FMEA FAILURE MODE LIGHT, DIMMER FAI AFTER DISCUSSIONS CRITICALITY.	E: LOSS (OF RETIO	CLE ILLUMI	NATION (BUL	B FAILS TO

ASSESSME ASSESSME NASA FME	NT	II		12/23/ GNC-70 NONE		5							ASA DATA: BASELINE NEW	[]	
SUBSYSTEMDAC ID:	M:			GNC 702 COAS												
LEAD ANA	LYS	ST	:	LES DF	lAS	PEI	LA.									
ASSESSME	NT	:														
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITE HDW/FUNC A B C											1					
	1	HDV	/FUI	1C		A			В			С				
NASA IOA	[3	/ /1R]	[P]	[P]	[P]	[] *	
COMPARE	[N	/N]	[N]	[N]	[N]	[]	
RECOMMEN	DA'	TI	ONS:	(If	d :	ifi	feren	t	fr	om NA	SA))				
	[3	/1R]	[P]	[P]	[P		[DD/DI] ELETE)
* CIL RE		NT:	ION 1	RATIONA	AL	E:	(If	ap	pl:	icabl			DEQUATE DEQUATE	[]	
REMARKS: IOA FAIL NASA/RI FMEA BEI	UR DI	D 1	TON	COVER 7	CH.	IS	FAIL	UR	E I SS	MODE.	•	102	A DOES R	ECOMI	MEND	A

ASSESSMENT ASSESSMENT NASA FMEA #	ID:	12/23/ GNC-70 07-1-7)3X	01-1					SA DA ASELI N		[x]	
SUBSYSTEM: MDAC ID: ITEM:		GNC 703 COAS												
LEAD ANALYS	T:	LES DE	RAPE	LA										
ASSESSMENT:														
CRI	SCREI	ENS	;			CI								
H	DW/FUI	NC .	A		В	В								
	3 /1R 3 /1R		[P]	[P]	[P P]		[]	*
COMPARE [/]	[]	[]	[]		[]	
RECOMMENDAT	ions:	(If	dif:	feren	t fr	om NAS	SA)							
[/]	[]	[]	[]	(AI	[DD/:	DE:] LE	TE)
* CIL RETEN	TION I	RATIONA	LE:	(If	appl	icable	•		EQUAT EQUAT		[]]	
REMARKS: IOA FAILURE FMEA FAILUR												-		

NO DIFFERENCES.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/23/80 GNC-710 NONE	6		NASA DATA BASELINE NEW	[]
MDAC ID:	GNC 710 CIRCUIT	- COAS	POWER			
LEAD ANALYST:	LES DRA	PELA				
ASSESSMENT:						
CRITICAI FLIGH		ANCY SCREE		CIL		
HDW/FU	INC	A	В	С		
NASA [/ IOA [3 /3] [NA]	[] [NA]	[] [NA]	[[] *]
COMPARE [N /N] [и]	[N]	[N]	[]
RECOMMENDATIONS:	(If d	ifferen	t from NAS	SA)		
[3 /3] [NA]	[NA]	[NA] (A	[DD/D] ELETE)
* CIL RETENTION	RATIONAL	E: (If	applicable	e) ADEQUATE INADEQUATE	[]
REMARKS: IOA FAILURE MODI NASA/RI DID NOT FMEA BEING WRITT	COVER TH	IS FAIL	URE MODE.	ICH FAILS CL IOA DOES R	OSED ECOM	MEND A

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	ONG 711		NASA DATA: BASELINE [NEW []	к]									
SUBSYSTEM: MDAC ID: ITEM:	GNC 711 CIRCUIT - C	COAS POWER											
LEAD ANALYST:	LES DRAPELA	A											
ASSESSMENT:													
CRITICALITY REDUNDANCY SCREENS CIL ITEM													
		3M											
NASA [3 /1R IOA [3 /3	HDW/FUNC A B C NASA [3 /1R] [P] [P] IOA [3 /3] [NA] [NA]												
COMPARE [/N] [N]] [N] [N] []									
RECOMMENDATIONS:	(If diffe	erent from NASA)											
[/] []] [] [] DELETE)									
* CIL RETENTION 1	RATIONALE:		ADEQUATE []									
FMEA FAILURE MODI SHORTS, INADVERT	INADEQUATE [] REMARKS: COA FAILURE MODE: SWITCH FAILS OPEN. PMEA FAILURE MODE: ALL CREDIBLE MODES (LOSS OF POWER, OPENS, SHORTS, INADVERTENT OUTPUT). AFTER DISCUSSIONS WITH NASA AND FURTHER ANALYSIS, IOA AGREES WITH												

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/23/80 GNC-712 05-6Y-20	6 02000-1		NASA DATA: BASELINE NEW							
SUBSYSTEM: MDAC ID: ITEM:	GNC 712	- COAS PO									
LEAD ANALYST:	LES DRA	PELA			•						
ASSESSMENT:											
CRITICAL	5	CIL ITEM									
FLIGH HDW/FU	NC	A	В	С							
NASA [3 /1F IOA [3 /3	NASA [3 /1R] [P] [P] [P] IOA [3 /3] [NA] [NA]										
COMPARE [/N] [и] [N] [n]	[]						
RECOMMENDATIONS:	(If d	ifferent	from NASA)							
[/] [] [) (] (AI	[] DD/DELETE)						
* CIL RETENTION	RATIONAL	E: (If ap	plicable) I	ADEQUATE NADEQUATE	[]						
REMARKS: IOA FAILURE MODIFMEA FAILURE MODISHORTS, INADVERSAFTER DISCUSSION THE NASA CRITICAL	DE: ALL C TENT OUTF NS WITH N	REDIBLE MOUT).	ODES (LOS	S OF POWER							

ASSESSM ASSESSM NASA FM	ENT	I	ATE: D:	3/20/ GNC-8 05-1-	01		-2						ASA D BASEL	INE	:] K]]	
SUBSYST MDAC ID ITEM:				GNC 801 ADTA													
LEAD AN	ALYS	ST	:	J.M.	HI	OT:	r										
ASSESSM	ENT:	:															
		F	ICAL:			RI A	EDUND		Y B	SCRE	EN.	s c			CIL		
			•						_			C					
NASA IOA	[3	/1R /1R]]	P P]]	P P]	[P P]		[]	*
COMPARE	[/]	[]	ĺ]	[]		[]	
RECOMMEN	radı	ric	ons:	(If	d:	if1	feren	t f	r	om NA	SA)					
	(/]	[]	[]	[]	(AD	[D/D:] ELI	ETE)
* CIL RE	URE	e M	ODE:	ERRO	VE(ous	OUT	PUT	•				DEQUAT DEQUAT		[]	·
FMEA FAI	LTOR	Œ	MODE	: ERRO	ONE	COU	S OUT	rPU'	Г.								

NO DIFFERENCES.

ASSESSMENT DATE: 3/20/87 ASSESSMENT ID: GNC-802 NASA FMEA #: 05-1-GN28-1													SA DA BASELI N	NE	[x]	
SUBSYSTE MDAC ID: ITEM:	M:			GNC 802 ADTA													
LEAD ANA	LYS	T:	:	J.M. H	IIC	TT	?										
ASSESSME	NT:	:															
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM												νſ					
		A			В			С									
NASA IOA	[3	/1R /1R]	[P P]	[P P]	[P P]		[]	*
COMPARE	[/]	[]	[]	[]		[]	
RECOMMEN	IDA'	rI	ons:	(If	đ.	if	ferer	nt	fr	om N	IASA)					
	[/	1	[]	ļ]	[]	(A)	[DD/D		
* CIL RI	ETE:	NT	ION	RATION	ΑL	E:	(If	aj	ppl	icab			DEQUA' DEQUA'		[]	
REMARKS: IOA FAII FMEA FAI NO DIFFI	LUR I LU	RE	MOD	: NO O E: LOS	UT S	PU' OF	T. OUTI	PU'	r.								

ASSESSMENT DATE: 3/20/87 ASSESSMENT ID: GNC-810 NASA FMEA #: 05-60-GN0801-1									1-1							ASA DA' BASELI N	NE	-		
SUBSYST: MDAC ID ITEM:				GN 81 AL	_	PO	WE:	R (CIRC	נט	T									
LEAD AN	ALY	ST	:	J.	M. 1	HI	OT.	r												
ASSESSMI	ENT	:																		
TOT T COLON											CIL ITEM									
	HDW/FUNC A									В С						111	SM			
NASA IOA	[3 3	/1R /1R]		[P P]		[P P]	İ	[[P P]		[]	*
COMPARE	[/	J		[]		[]	1]]		[]	
RECOMMEN	IDA!	ric	ons:		(If	d:	if1	fer	ent	f	rc	m	NAS	Y)						
	[/]		[]		[]	1	•			(AC	[D/D		ETE ;
* CIL RE	TEI	T	ON I	TAS	IONA	L	Ξ:	(I	fa	qq	1 i	.ca	ble)				_	_		
REMARKS:																EQUATE EQUATE		[]	
IOA FAII FMEA FAI CLOSES, NO ACTIO	LUI	RE Em <i>a</i>	MODE TURE	E: 0	CIRC PERA	UI. LT	T ON	BR	EAKI	ER RT	-A S.	LL	CRE		ΙB	LE MOD	ES	OP	ENS	5,

ASSESSME ASSESSME NASA FME				108	01-1	L								DA ELI N		[]				
SUBSYSTE MDAC ID:				GN 81 AD		OF	Æ	CIF	RCU	ΙI	т											
LEAD ANA	LYS	ST	:	J.	м. н	IC	TT	!														
ASSESSME	NT	:																				
			ICALI				RE	DUNI	DAN	IC	Y	SCI	REE	NS	3					IL TEN		
			W/FUI				A				В				С							
NASA IOA	[[3 3	/1R /3]]	P NA]	0	:	P NA]		[[P NA]			[[]	*
COMPARE	[/N]		[N]	[•	N]		[N]			[3	
RECOMMEN	DA!	TI(ons:		(If	đ:	if1	fere	nt	f	rc	m I	NAS.	A))							
	[/]		[]	(]		[]				/DI		ETE)
* CIL RE	TE	NT:	ION I	RAT	IONA	L	€:	(If	aŗ	pŗ	1i	.ca	ble)	Αſ	DEO	UAT	ГE	ſ		1	
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REMARKS: IOA FAII FMEA FAI CLOSES,	LUR LU PR	RE EM	MOD:	E: E O	CIRC	TU:	IT IOI	BRE	AKI HOI	EI Ri	₹-A	LL	CR		,						PE	NS,

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	3/23/87 GNC-812 05-60-GN	N0802-1		NASA DATA BASELINE NEW	
SUBSYSTEM: MDAC ID:	GNC 812 ADTA POW				
LEAD ANALYST:	J.M. HIC	OTT			
ASSESSMENT:					
CRITICAL: FLIGH		REDUNDA	NCY SCRE	ENS	CIL ITEM
HDW/FU		A	В	С	ITEM
NASA [3 /3 IOA [3 /3] [NA] NA]	[NA] [NA]	[NA] [NA]	[] *
COMPARE [/] []	[]	[]	[]
RECOMMENDATIONS:	(If di	ifferent	from NAS	SA)	
[/] [1	[]	[] (A	[] DD/DELETE)
* CIL RETENTION 1	RATIONALE	E: (If a	pplicable	e) ADEQUATE INADEQUATE	į j
REMARKS: IOA FAILURE MODE: OPENS.	: RESISTO	OR (RLRO	7C5101GR)	-	• •
FMEA FAILURE MODI SHORTED TO GROUNI NO DIFFERENCES.	E: ALL CF	REDIBLE 1	MODES -	OPENS, OUT	OF TOLERANCE

ASSESSME	ASSESSMENT DATE: 3/20/ ASSESSMENT ID: GNC-9 NASA FMEA #: 05-1- SUBSYSTEM: GNC MDAC ID: 901													1		SA DAT ASELIN NE	E	(x]	
SUBSYSTE MDAC ID: ITEM:				GN	C 1															
LEAD ANA	'TAS	ST:	:	TR	AHAN	Ι,	W.	н.												
ASSESSME	NT:	:																		
	CR		CAL LIGH		•		RE	DUND	AN	C.	Y	SCRE	EN	is				CIL		
	I	_	/FU				A]	В				С					
nasa Ioa]	3 3	/1R /1R]		[P P]	[P P]	(:	P P]		[]	*
COMPARE	[/	3		[]	[]	1]		[]	
RECOMME	NDA'	TI	ons:		(If	d :	ifí	feren	t	f	r	om NA	SZ	A)						
	[/]		[]	(•]		[]	(AI	[DD/D	EL:	ETE)
* CIL R	ETE	NT	ION	RAT	CION	AL	E:	(If	aŗ	qq	1:	icabl				DEQUAT!		-]	
REMARKS IOA FAI FMEA FA FIRST F SECOND FLIGHT MAY IMP	LUR ILU AIL FAI RUL ACT	RE UR LU ES	MODE WITE MICE MICE MICE MICE MICE MICE MICE MIC	E: LL IAY TA'	LOS: BE NOT TES	S DE B PR	OF TE E 1	OUTP CTED ANNUN RITY	U'. Al IC: F:	r. ND IA LI	T G	ED, E HT FO	3U' DR	r J	M' H'l	E LOSS	D.	ロIC(. I .	

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	3/20/87 GNC-902 05-1-FC	1042-2		NASA DATA BASELINE NEW	
	GNC 902 RGA				
LEAD ANALYST:	TRAHAN,	W. H.			
ASSESSMENT:					
CRITICAL: FLIGHT		REDUNDAN	CY SCREENS	5	CIL
	NC	A	В	С	ITEM
NASA [2 /1R IOA [3 /1R] [P] [P] [F] [P] [P] P]	[X] *
COMPARE [N /] [] [n] [1	[N]
RECOMMENDATIONS:	(If di	fferent	from NASA)		
[/] [) [] [[] DD/DELETE)
* CIL RETENTION F	RATIONALE	: (If ap		1 DELOTES mm	
REMARKS:			IN	ADEQUATE ADEQUATE	[X]
IOA FAILURE MODE: FMEA FAILURE MODE FIRST FAILURE WIL	: ERRONE	OUS OUTP	ידני.	Vima Diagram	
FIRST FAILURE WIL THE SECOND FAILUR DETECT. FLIGHT R	CE MAY NO RULES INV	T BE ANN OKE PRIO	UNCIATED, RITY FLIGH	BUT THE MO	CC CAN
FAILURE. MAY IMP ADDITIONAL IOA AN FAILED THE B SCRE FMEA FOR THE WORS	ALYSIS C En. Thi	HANGED TI S RESULTS	HE HARDWAR S IN NO DI	E CRITICAL FFERENCE W	ITY TO 2 AND

RM TRIP LEVEL.

ASSESSMEI ASSESSMEI NASA FME	ASSESSMENT DATE: 3/20/ ASSESSMENT ID: GNC-9 NASA FMEA #: 05-60 SUBSYSTEM: GNC								000	1					ASA D BASEL		[
SUBSYSTEM MDAC ID:				903	3	7 F	RGA	1,2	2,3	, 4									
LEAD ANA	LYS	ST	•	TRA	HAN	Ι,	W.	н.											
ASSESSME	NT:	:																	
	CRI		ICAL:				RE	DUNI	AN	CY	so	CREE	NS	3			CI		
	F		/FUI				A			В	}			С					
NASA IOA	[3 3	/1R /1R]]	P P]	(P]		[P P]		[]	*
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RECOMMEN	DA!	ri	ons:		(If	d:	ifí	fere	nt	fr	om	NAS	SA))					
	[/]		[]	1	•	3		[]			DEL:	ETE)
* CIL RE	TEI	NT:	ION 1	RAT:	IONA	AL	Ε:	(If	ar	p)	ica	able	≥) II	AI NAI	DEQUA DEQUA	TE TE	[]	
REMARKS: IOA FAIL FMEA FAI SHORT TO SWITCHES NO DIFFE	LUI GI	RE ROI AI	MOD: UND, ND 4	E: IN'	PRI FERI	EM.	ATU L S	JRE (SHOR	OPI T.	ERA	TI(ΑD	VERTE	:NTL	<i>t</i> 0	PEN	s,

ASSESSME ASSESSME NASA FME SUBSYSTE	NT NT A	Di Ii	ATE: D:	3/2 GNC 05-	20/8 2-90 -60-	37 04 -2(00:	301·	-1							ASA BAS	ELI		[
SUBSYSTE MDAC ID:	M:			904	C L DDES																		
LEAD ANA	LYS	T	:	TRA	HAN	Ι,	W	. н	•														
ASSESSME	NT:	3																					
		F	ICAL:	r					NDA	NC										IL PEM			
	1.	IDI	W/FUI	NC			A				В				С								
NASA IOA	[3	/1R /1R]		[[P P]		[F P]]	P P]			[X]	*	
COMPARE	[/]		[]		[N]		[]			[N]		
RECOMMEN	DAI	'IC	ONS:	(Ίf	d:	ifi	fere	ent	f	ro	om	NAS	A))								
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* CIL RE	TEN	T]	ON I	RATI	ONA	LI	Ξ:	(I1	f aı	go) 1 i	ca	ble)									
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REMARKS:															W)EQ.	DAI	E	L		J		
IOA FAIL FMEA FAI FAIL TO	LUR	Œ	MODE											L	EC7	RIC	CAL) -1	FA]	LS	; c	PEI	٧,
FIRST FA				ETE	CTE	:D	BU	JT (CURI	RE	LV:	· s	TIL	L	CC	NDI	JCT	ED	ጥር) Т	'HF	!	
RGA'S.	THE	: 5	SECO	VD F	'AIL	UI	Œ	ON	THI	Ξ	SA	ME	RG	A	IS	D	ETE	CTA	ABI	Œ	IN	•	
FLIGHT. ANNUNCIA	TH TEC	LE) F	UTUO IR VE	PUT 1	FRO	M GF	TE TE	IIS RIII	RGA LES	A D	WI OTC	LL. מידי	BE TES	I)IS	CAI	RDE:	D /	INI) :धग	, E	ďΩ	מונות
LOSS OF	ONE	:																					
RGA. BE RECOMMEN THIS BEC	DS OME	AI S	DDITI A CI	IONA [L I	L C TEM	:ON	ISI	DEF	RAT:	ΙO	N	BE	GI	VE	EN	AS	то	WI	CAI	THE	R	OR	IOA NOT
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ASSESSME ASSESSME NASA FME	NT NT A #	20/8 C-90 -60-	7 4 A FC	:10	44-00	00	1					SA DAT ASELIN NE	E	[x]				
SUBSYSTE MDAC ID:	M:			GN 90 DI	4	&	R	ESIS'	r	(01	RB)							•
LEAD ANA	LYS	T:	}	TR	AHAN	,	W.	н.							,				
ASSESSME	NT:	3																	
	CRI		CAL				RE	DUND	AN	CY	S	CREE	NS	3			CIL		
	I		V/FUI				A			В				С					
NASA IOA	[3	/1R /1R]]	P P]	[P P]		[P P]		[]	*
COMPARE	[/]		[]	[3		[]		[]	
RECOMMEN	IDA'	ri	ons:		(If	đ:	if	feren	t	fr	on	n NAS	SA)					
	[/]		[1	[•]		[]	(Al	[D/DC		
* CIL R	ETE	NΤ	ION	RAT	ION	ΑL	E:	(If	ar	pl	ic	cable			DEQUAT:	E E	[]	
REMARKS IOA FAI FMEA FA RGA'S 1 NO DIFF	LUR ILU AN	RE D	MOD 4 AR	E:	(R)	ES	IS'	TOR)	O)	5EV	₹,	SHO							CE.

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	SUBS MDAC ITEM	ID:				GN 90 RF		(OR	B)												
	LEAD	ANA	LY	ST	:	TF	IAHAS	N,	W	. 1	н.											
	ASSE	SSME	NT	:																		
			CR:		ICAL LIGH		•		R	EDU	JND	AN(CY	sc	CREE	NS			CII			
			1		/FU				A				В			C	2		ITE	M		
	NZ	ASA IOA	[3 3	/1R /1R]]	P P]		[P P]		[E	?]		[]	*	
(COMPA	ARE	[/]		[]		[]		[]		נ]		
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t	REMAR	ve.													נ	A AN:	DEQUAT DEQUAT	E E	[]		
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ASSESSMENT DATASSESSMENT ID:	GNC-9	50	PREL RE	F NO.	NASA DATA BASELINE NEW]
SUBSYSTEM: MDAC ID: ITEM:	GNC 950 RGA (S	SRB)					
LEAD ANALYST:	LES D	RAPELA					
ASSESSMENT:							
FL	GHT		UNDANCY			CIL ITE	
HDW,	FUNC	A	В		С		
NASA [3 / IOA [3 /	'1R] '1R]	[P] [P]	[P [P] [P] P]	[] *
COMPARE [′]	[]	ſ] [1	[]
RECOMMENDATION	NS: (If	diffe	rent fr	om NASA)		
[,	/] .	[]	[] [] (2	[DD/D] ELETE)
* CIL RETENTION REMARKS: IOA FAILURE MO	DDE: LOS	s of c	OUTPUT.		ADEQUATE NADEQUATE]
FMEA FAILURE	MODE: LO	SS OF	OUTPUT.				

NO DIFFERENCES.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/23/86 GNC-951 05-01-(10), PRE	L REF NO.	NASA DATA BASELINE NEW	: [] [x]
SUBSYSTEM: MDAC ID:	GNC			
LEAD ANALYST:	LES DRAPELA			
ASSESSMENT:				
FLIGHT	ITY REDUNDA I NC A	NCY SCREENS	c	CIL ITEM
		rea r		f Y 1 *
IOA [3 /1R] [P]] [P]	[F] [[P] [Pj	[X] * []
COMPARE [N /] []	[и]]	[N]
RECOMMENDATIONS:	(If different	from NASA)		
[, /] []	[] [[] DD/DELETE)
* CIL RETENTION F	RATIONALE: (If a		ADEQUATE ADEQUATE	[]
IOA FAILURE MODE: FMEA FAILURE MODE AFTER DISCUSSIONS THE NASA CRITICAL DETECTED BY FDIR. IS BELOW THE FDIR DETECTED AND THE	E: ERRONEOUS OU S WITH NASA AND LITY. FOR MOST FOR A WORST C R THRESHOLD VALU	TPUT. FURTHER ANA CASES, ERRO ASE SCENARI E, THE ERRO	NEOUS ERRO O IN WHICH R WILL NOT	ORS WILL BE I THE ERROR BE

FILTER WHERE IT COULD BE SELECTED.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/23/86 GNC-960		ASA DATA: BASELINE NEW	-	
SUBSYSTEM: MDAC ID: ITEM:	GNC 960 CIRCUIT - SRB	RGA POWER			
LEAD ANALYST:	LES DRAPELA				
ASSESSMENT:					
CRITICAL: FLIGHT HDW/FUI	r	DANCY SCREENS B C		CIL ITEM	
NASA [/ IOA [3 /1R] []]	[] [P]	[] *	
COMPARE [N /N] [N]	[и] [и]	[]	
RECOMMENDATIONS:	(If differer	nt from NASA)			
[/] []	[] [] (AD	[] DD/DELET	E
* CIL RETENTION :	RATIONALE: (If	A	DEQUATE DEQUATE	[]	

ASSESSMI ASSESSMI NASA FMI	ENT	I			/23/8 C-961									ASA DA BASELI N		[]	
SUBSYSTI MDAC ID ITEM:				GNO 961 CIE	-	-	SRI	B Ro	GA	F	OWER							
LEAD AN	ALY	ST	:	LES	DRA	PE:	LA											
ASSESSMI	ENT	:																
		F	ICAI LIGH W/FU			RI A	EDUì	NDAI		Y B	SCRE	EN	s C			CII		
NASA IOA]	3	/ /3]	[N] A]	[NA]	[N2] A]		[]	*
COMPARE	(N	/N]	[N]	-		N]	[N]		[]	
RECOMMEN	IDA:	ric	ONS:	(If d	ifi	fere	ent	f	ro	m NA	SA)					
	[/]	[]	(•]	[]	(AE	[D/D	ELI	ETE,
* CIL RE	ETE	NT:	ON	RATI	ONALI	E:	(If	aŗ	q	li	cabl			EQUAT		[]	

REMARKS:

ASSESSMEI ASSESSMEI NASA FME	I TN	D:	GNC-10	2/23/86 NASA DATA: IC-1001 BASELINE [] 5-1-FC2042-1 NEW [X]												
SUBSYSTEM MDAC ID: ITEM:	M:		GNC 1001 ACCELE	RC	OME	TER	AS	SE	MBI	.Y						
LEAD ANA	LYSI	r:	LES DE	lAS	PEI	A										
ASSESSME	NT:															
,	1	rical FLIGH DW/FU			RE A	EDUND	AN	CY B		REENS	S C			CIL	1	
NASA IOA	[:	3 /1R 3 /1R]	[P P]	[P]	[P P]		[]	*
COMPARE	[/]	[]	(]	[1		[]	
RECOMMEN	DAT:	ions:	(If	đ	if	feren	ıt	fr	om	NASA)					
	[/]	[1	ſ	•]	[]	(Al	[DD/DI		ETE)
* CIL RE	TEN'	TION	RATION	AL	Е:	(If	aŗ	ppl	ica			DEQUAT:		[]	
REMARKS: IOA FAII FMEA FAI NO DIFFE	URE	E MOD	: NO O	UT S	PU' OF	r. OUTI	PU:	r.								

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/23/86 GNC-1002 05-1-FC20	42 - 2		NASA DATA BASELINE NEW								
SUBSYSTEM:	GNC 1002 ACCELEROM											
LEAD ANALYST:	LES DRAPE	LA										
ASSESSMENT:												
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM												
	ic a	В		С	TIEM							
NASA [2 /1R IOA [3 /1R] [P] [P] [F] [P] P]	[X] *							
COMPARE [N /] [] [N] []	[N]							
RECOMMENDATIONS:	(If diff	erent fr	om NASA)									
[/] [] [] [[] DD/DELETE)							
* CIL RETENTION R	ATIONALE:	(If appl										
REMARKS:			IN	ADEQUATE ADEQUATE	[X]							
IOA FAILURE MODE: FMEA FAILURE MODE	: ERRONEOU	S OUTPUT	•									
AFTER DISCUSSIONS WITH NASA AND FURTHER ANALYSIS, IOA AGREES WITH THE NASA CRITICALITY. FOR MOST CASES ERRONEOUS ERRORS WILL BE DETECTED BY FDIR. FOR A WORST CASE SCENARIO IN WHICH THE ERROR IS BELOW THE FDIR THRESHOLD VALUE, THE ERROR WILL NOT BE DETECTED AND THE ERRONEOUS DATA WILL BE SENT TO THE SELECTION FILTER WHERE IT COULD BE SELECTED.												

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/23/86 GNC-1010 05-60-F0	5) C1045-00	01	NASA DATA BASELINE NEW	
SUBSYSTEM: MDAC ID:	GNC 1010		& 2 POWER		
LEAD ANALYST:	LES DRA	PELA	ı		
ASSESSMENT:					
FLIGH'	r		NCY SCREE		CIL
HDW/FU	NC	A	В	С	
NASA [3 /1R IOA [3 /3] [P] NA]	[P] [NA]	[P] [NA]	[] *
COMPARE [/N] [N]	[и]	[N]	[]
RECOMMENDATIONS:	(If d	ifferent	from NAS	A)	
[/) [1	[]	[] (A)	[] DD/DELETE)
* CIL RETENTION	RATIONAL	E: (If a	pplicable	ADEQUATE	
REMARKS: IOA FAILURE MODE FMEA FAILURE MODE THE FMEA COVERED HIGHEST CRITICAL	E: CIRC TWO FAI	UIT BREA LURE MOD	KER FAILS ES, BUT I	2) FAILS CL OPEN, FAIL OA AGREES W	OSED. S CLOSED. ITH THE

ADDITIONAL FMEA IS RECOMMENDED.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/23/86 GNC-1011 05-60-FC	1	NASA DATA BASELINE NEW		
MDAC ID:	GNC 1011 CIRCUIT-	·AA'S 1 &	2 POWER	₹	
LEAD ANALYST:	LES DRAP	ELA			
ASSESSMENT:					
FLIGHT	-		CY SCREE		CIL ITEM
HDW/FUI	NC	A	В	С	
NASA [3 /1R IOA [3 /1R] [P] [P] [P] P]	[P] [P]	[] *
COMPARE [/] [] []	[]	[]
RECOMMENDATIONS:	(If di	fferent	from NAS	SA)	
[/] [) []	[] (A)	[] DD/DELETE)
* CIL RETENTION I	RATIONALE	: (If app	plicable	e) ADEQUATE INADEQUATE	[]
REMARKS: IOA FAILURE MODE: FMEA FAILURE MODE THE FMEA COVERED HIGHEST CRITICAL: ADDITIONAL FMEA	E: CIRCU TWO FAIL ITY WHICH	IT BREAK URE MOES IS FOR	ER FAILS	2) FAILS OP OPEN, FAIL OA AGREES WIT	EN. S CLOSED. TH THE

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/23/86 GNC-1012 05-60-(0	5 2 03), PR	EL REF NO.	NASA DATA: BASELINE NEW		
	1012	- AA' S 3	& 4 POWER	1		
LEAD ANALYST:	LES DRAI	PELA				
ASSESSMENT:						
CRITICAL: FLIGH		REDUND	ANCY SCREE	ens	CIL ITEM	1
HDW/FU		A	В	С		,
NASA [3 /1R IOA [3 /1R] [P] P]	[P] [P]	[P] [P]	[] *
COMPARE [/] []	[]	[]	[]
RECOMMENDATIONS:	(If d	ifferen	t from NAS	SA)		
[/] []	[]	[] (A	[DD/DE] ELETE)
* CIL RETENTION	RATIONAL	E: (If	applicable	≥) ADEQUATE INADEQUATE	[]
REMARKS: IOA FAILURE MODE FMEA FAILURE MOD RESISTANCE.	: POWER	CIRCUI TING RE	T (AA'S 3	4) FAILS OP	EN.	

NO DIFFERENCE.

ASSESSMENT DATE: 12/23/86 ASSESSMENT ID: GNC-1012A NASA FMEA #: 05-60-(04), PREL REF NO. NEW [X]												
SUBSYSTEM: MDAC ID: ITEM:	GNC 1012 CIRCUIT-AA'S	3 & 4 POWER										
LEAD ANALYST:	LES DRAPELA											
ASSESSMENT:												
CRITICAL: FLIGHT		NDANCY SCREEN	s	CIL ITEM								
	NC A	В	С	IIEM								
NASA [3 /1R IOA [3 /1R] [P]] [P]	[P] [[P] [P] P]	[] *								
COMPARE [/] []	[] [1	[]								
RECOMMENDATIONS:	(If differ	ent from NASA)									
[/] []	[] [[] DD/DELETE)								
* CIL RETENTION F	RATIONALE: (I			_								
DFMADVC.		I	ADEQUATE NADEQUATE	[]								
REMARKS: IOA FAILURE MODE: POWER CIRCUIT (AA'S 3&4) FAILS OPEN. FMEA FAILURE MODE: SWITCH FLT CONTROL (AA 3&4) - PREMATURE OPERATION, SHORTS, OPENS. NO DIFFERENCE.												

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	: []							
MDAC ID:	GNC 1012 CIRCUIT	-AA'S 3	& 4	POWER					
LEAD ANALYST:	LES DRA	PELA							
ASSESSMENT:									
CRITICAL FLIGH		REDUNDA	ANCY	SCREE	NS		CIL		
	NC	A	В		С			. –	
NASA [3 /1R IOA [3 /1R] [P] P]	[P]	[P]			
COMPARE [/] [. 1	[]	ָ]	[]	
RECOMMENDATIONS:	(If d	ifferen	t fro	om NAS	A)				
[/] [1	[]	[] (2	[ADD/D		2)
* CIL RETENTION	RATIONAL	E: (If	appli	cable) AI	DEQUATE DEQUATE	[]	
REMARKS: IOA FAILURE MODE FMEA FAILURE MOD OPENS, PREMATURE	E: RPC	- Loss	T (AA OF OU	\'S 3&	4) I	FAILS OF	PEN.		

ASSESSMEI ASSESSMEI NASA FME	NT ID:	12/23/8 GNC-101 NONE			NASA DATA BASELINE NEW	[]
SUBSYSTEM MDAC ID:		GNC 1013 CIRCUIT	-AA'S 3	& 4 POWER	₹		
LEAD ANA	LYST:	LES DRA	PELA				
ASSESSME	NT:						
(FLIGH'	r		ANCY SCREE	ens	CIL	1
	HDW/FU	NC	A	В	С		
NASA IOA	[3 /3] [P]	[] [P]	[] [P]	[] *
COMPARE	[N /N]. [n j	[N]	[N]	[]
RECOMMEN	DATIONS:	(If d	ifferent	t from NAS	iA)		
	[3 /3] [NA]	[NA]		[DD/DE] ELETE)
* CIL RET	rention i	RATIONALI	E: (If a	applicable	ADEQUATE	[]
REMARKS: IOA FAILU NASA/RI I	DID NOT	COVER THE	S FAILU	T (AA'S 3& JRE MODE.	INADEQUATE 4) FAILS CLO IOA DOES RI	SED.	_
rmea bell	AL- MKI'''I'	'N PCH ('C	JM P L. K'I'K'I	IRSS.			

ASSESSMENT ASSESSMENT NASA FMEA #	DATE: ID:	3/25/8 GNC-10 05-60-	/25/87 NASA DATA: NC-1014X BASELINE [] 5-60-200501-1 NEW [X]]		
SUBSYSTEM: MDAC ID: ITEM:		GNC 1014 DIODE				POWEF	≀ c	IR	CUITS				
LEAD ANALYS	T:	LES DR	APE	ELA									
ASSESSMENT:													
FLIGHT REBUNDANCI BERMENS										CIL ITEM			
FLIGHT HDW/FUNC A B C													
NASA [IOA [3 /1R 3 /1R]	[]	P] P]	[F [F]]	P P]	[X X]	*
COMPARE [/]	[1	[]	[]	[]	
RECOMMENDAT	rions:	(If	di :	fferen	t fr	om NAS	SA))					
τ	/]	[]	[]	[/DI		ETE)
* CIL RETEN	NTION	RATION	ALE	: (If	appl	icabl		AI IAN	DEQUATE DEQUATE	[]	
REMARKS: IOA FAILURE MODE: DIODE FAILS OPEN. FMEA FAILURE MODE: OPEN (ELECTRICAL). AA'S 3 & 4 HAVE TWO POWER CIRCUITS. THE LOSS OF ONE DIODE REMOVES ONE POWER CIRCUIT ONLY. THE OTHER CIRCUIT CONTINUES TO SUPPLY POWER TO THE RGA. THE LOSS OF ONE DIODE CANNOT BE DETECTED, THEREFORE SCREEN B IS FAILED. NO CIL RETENTION RATIONALE WAS AVAILABLE AT THE TIME OF THIS ASSESSMENT.													

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	GNC-110:			NASA DATA BASELINE NEW	
	GNC 1101 ASA				
LEAD ANALYST:	ROBERT O	O'DONNEI	LL		
ASSESSMENT:					
FLIGH'			NCY SCREI	ENS C	CIL ITEM
NASA [/ IOA [3 /1R] [P]	[] [P]	[] [P]	[] *
COMPARE [N /N] [N]	[и]	[N]	[]
RECOMMENDATIONS:	(If di	ifferent	from NAS	SA)	
[3 /1R] [P]	[P]		[] DD/DELETE)
* CIL RETENTION I	RATIONALE	E: (If a	pplicable	ADEQUATE INADEQUATE	[]
REMARKS: IOA FAILURE MODE: FMEA FAILURE MODE IT IS NOT CLEAR TO 05-1-FC6042-2 (EI PROVIDE ADDITIONA ANALYZED. IOA DO COMPLETENESS. TE	E: NONE. THAT NASA RRONEOUS AL INFORM DES RECOM HE ISOL C	A/RI COV OUTPUT) (ATION I (MEND TH	ERED THIS CRIT 3/1 N FMEA TO AT A NEW FF WILL I	CHN. FAILURE MODE R. RECOMMENT CLARIFY FAIL FMEA BE WRITH CHIBIT THE I	DE IN FMEA ID NASA/RI ILURE MODES
THE CHN IF AN ASA	SYSTEM	FAILURE	IS DETEC	TED.	

ASSESSME ASSESSME NASA FME	ENT	II):			2							ASA DATA BASELINE NEW	[]	
SUBSYSTE MDAC ID:				GNC 1102 ASA													
LEAD ANA	LYS	ST:	:	ROBER	T	ם'כ	ONNE	LL									
ASSESSME	ENT	:											•				
	CR		ICALI LIGHT	TY r		RE	DUND	AN	CY	SCR	EENS	3			IL TEM	ī	
	1			IC		A			В			С					
NASA IOA	[3	/ /1R]]	P]	[P]	[P]	[]	*
COMPARE	[N	/N	1	[N]	[N]	[N]	[]	
RECOMMEN	NDA'	ri	ons:	(If	đ:	if1	ferent	t	fr	om N	(ASA)	·				
	[3	/1R]	[P]	(P]	[P] (2		/DI		ETE)
* CIL RI	ETE	NT:	ION 1	RATION	IAL	E:	(If	ap	pl:	icab		Δ	DEQUATE DEQUATE	[]	•
REMARKS IOA FAIL FMEA FAIL IT IS NO 05-1-FCO PROVIDE ANALYZEI COMPLET	LUR ILU OT 604 AD	RE CL 2- DI	MODE EAR ' 2 (E) TIONE OA D	E: NON THAT N RRONEC AL INI	NE. NAS. DUS FOR	A/I OU MA	RI CO UTPUT FION	VE) IN	RE CR	D TH IT 3 MEA	IE CI	HN FA	ILURE MO RECOMMI ARIFY FA	ODE END	II NZ URI	asa E N	IODE:

ASSESSME NASA FME	ASSESSMENT ID: GNC-1103 NASA FMEA #: 05-1-FC6042-1											ASA D BASEL		[
SUBSYSTEMDAC ID:	M:		GNC 1103 ASA														
LEAD ANA	LYST:		ROBER	r (0'!	DONNE	LL	ı									
ASSESSMEI	NT:																
(FI	IGH?		REDUNDANCY A B				CY B				c			CIL ITEM		
NASA IOA	[2 [2	/1R /1R]	[P P]	[F P]	[P P]		[x x]	*
COMPARE	[/]	ĺ]	[N]	[]		[)	
RECOMMENI	DATIO	NS:	(If	d:	if1	feren	t :	fro	om NA	· .SA))						
	[/]	[]	[]	[]			'DE		TE)
* CIL RET	PENTI	ON F	RATION	ALI	€:	(If a	apj	pl:	icabl	•	AI IAI	DEQUA!	PE PE	[x]	
IOA FAILU FMEA FAIL IOA DOES IN THE NA OUTPUT) H BY THE AS SYSTEMS W UNDETECTE WILL CAUS VEHICLE. FAILURE A	ADEQUATE [X] INADEQUATE [] REMARKS: IOA FAILURE MODE: NO POSITION ERR CMD TO ACTR CHN (NULL OUTPUT). FMEA FAILURE MODE: LOSS OF OUTPUT. IOA DOES CONCUR WITH NASA'S REEVALUATION AND RATIONALE AS SHOWN IN THE NASA-JSC FMEA REVIEW COMMENTS. DUAL NULL (ASA LOSS OF OUTPUT) FAILURES OF AEROSURFACE RATE COMMANDS WILL BE UNDETECTED BY THE ASA DELTA P FAULT DETECT CIRCUIT AND MCC MONITORING SYSTEMS WHILE SURFACE POSITIONS ARE NOT CHANGING. THE TWO UNDETECTED NULL FAILURES, DURING ATMOSPHERIC FLIGHT MANEUVERS, WILL CAUSE A 2 ON 2 CHN FORCE FIGHT AND MAY RESULT IN LOSS OF VEHICLE. AS A RESULT OF NASA REVISIONS, AND FURTHER IOA ASA FAILURE ANALYSIS, IOA DOES NOT RECOMMEND A CHANGE TO THE EXISTING FMEA REDUNDANCY SCREEN B.																

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/23/87 GNC-1104 05-1-FC6		2			SA DATA BASELINE NEV]
SUBSYSTEM: MDAC ID: ITEM:	GNC 1104 ASA							
LEAD ANALYST:	ROBERT (ומסם י כ	NELL					
ASSESSMENT:								
CRITICAL FLIGH		REDUI	NDANCY	SCREE			CIL ITEN	1
HDW/FU	NC	A	В		С			
NASA [3 /1F	[]	P] P]	[P [P]	[P [P]]] *
COMPARE [/] []	[]	[1	(]
RECOMMENDATIONS:	(If d	iffer	ent fro	om NAS	A)			
] []	ĺ	1	[] ([ADD/D] ELETE)
* CIL RETENTION	RATIONAL	E: (I	f appl	icable	A.	DEQUATE DEQUATE]
REMARKS: IOA FAILURE MODI FMEA FAILURE MODI	E: ERRONE	OUS P	OSITIO OUTPUT	N ERRO	R C	MD TO A	CTR.	

NO DIFFERENCES.

ASSESSI ASSESSI NASA FI	ME:	NT	'I	D	:	G	NC-	/81 110	7 05										DAI ELIN NE	'A: IE [IW []		
SUBSYST MDAC II ITEM:	rei D:	M:				GI 1: A:	105																
LEAD A	NA]	LY	ST	:		R	OBEI	RT	0'	DC	NNE:	LL											
ASSESSI	1E)	T	:																				
	(CR.	TI T	IC T.1	CALI	ETY	Z		R	EC	UND	AN	CY	S	CRE	EN	s			CI			
]			/FUI	_			A				В				С			IT	EM		
NAS? IO?	7	[3		′ ′1R]		נ נ	P]		[P]		[P]] []	*	
COMPARE	2	[N	/	'N]		[N]		[N]		[N	1		[]		
RECOMME	NE	A.	ric	NC	is:		(If	đ	if	fe	rent	- 1	fro	m	NAS	SA))						
		[3	/	'1R]		[P]		[P]		[P]	(2	[ADD/1] DELJ	ETE)	
* CIL R	ΕΊ	'EI	T)	[0	N F	TAS	ION	AL	E:	(If a	ıpı)li	.ca	able	≥)							
REMARKS	•															IN	AI IAI	EQU.	ATE ATE	[]		
IOA FAI FDBK XD FMEA FA	LU CR	. •	·un	٠,					PU'	r,	OR	EF	RC	NE	ous		ľŪ	PUT	ON	ONE	POS	ITI	ON.
IT IS N 05-1-FC IN FMEA DOES RE	OT 60 0	4 2 5 -	LE 2-2	EA 2. -F	R T S C60	HA IN 42	T N CE -2	AS. TH: AN:	D I	F/ LAS	AILU S TH	RE E	: M Sa	OE MF	E A	FF	EC	TS	ERRO	NEOU	JS C	UTP	TTO

ASSESSMEN ASSESSMEN NASA FMEA	T	ID):	1/2 GNC NON	-11	7 06											DATA LINI NEV]		
SUBSYSTEM MDAC ID:				GNC 110 ASA	6																	
LEAD ANAI	YS	T:	;	ROE	BERT	C) ' D	ON	NEI	L												
ASSESSMEN	T:	3																				
C	R		[CAL]				RE	DU	NDA	N	CY	sc	REE	NS	;			CI	L EM	ſ		
	ŀ		LIGHT V/FUI				A				В				С							
NASA IOA]	3	/ /1R]]	P]		[P]] [P]]]	*	
COMPARE	[N	/N]		[N	3		[N	3		[N]		[]		
RECOMMEN	DA!	ric	ons:		(If	d:	if1	fer	ent	t :	fro	om	NAS	A))							
	[3	/1R]		[P]		[P]		[P]	([ADD,	/DI		ETE))
* CIL RE	re:	NT:	ION :	RAT:	IONA	L	E:	()	[f a	ap	p1 :	ica	able				UATE UATE]		
REMARKS: IOA FAIL FDBK XDC FMEA FAI IT IS NO	R TIT	CH DF	N. Mod	ਸ• '	NONE	₹							THIS	} ;	FA:	ILU		ODE	I	N I	FME	A

05-1-FC6042-2. SINCE THIS FAILURE MODE AFFECTS ERRONEOUS OUTPUT IN FMEA 05-1-FC6042-2 AND HAS THE SAME CRITICALITY (3/1R), IOA DOES RECOMMEND THAT A NEW FMEA BE WRITTEN FOR COMPLETENESS.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	GNC-1107			SA DATA: BASELINE [NEW [
	GNC 1107 ASA				
LEAD ANALYST:	ROBERT O'	DONNELL			
ASSESSMENT:					
CRITICAL: FLIGHT	C:	IL TEM			
HDW/FUI	NC A	В	С		I EM
NASA [/ IOA [3 /1R] [P] [P] [] [P] [] *]
COMPARE [N /N] [N	[и] [N] [1
RECOMMENDATIONS:	(If dif	ferent fro	om NASA)		
[3 /1R] [P] [P] [P] /DELETE)
* CIL RETENTION F	RATIONALE:	(If appli	ADI	EQUATE []
REMARKS: IOA FAILURE MODE: P FDBK XDCR CHN. FMEA FAILURE MODE	: NONE.		S OUTPUT (ON 1 ELVN	PR1 DELTA
IT IS NOT CLEAR TO 05-1-FC6042-2. SIN FMEA 05-1-FC60 DOES RECOMMEND THE	SINCE THIS 42-2 AND F	FAILURE M HAS THE SA	ODE AFFECT ME CRITICA	TS ERRONEC	US OUTPUT

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	GNC-1108			NASA DATA: BASELINE NEW	r 1	
	GNC 1108 ASA					
LEAD ANALYST:	ROBERT O	DONNEL	L			
ASSESSMENT:						
CRITICAL		REDUNDA	NCY SCREEN	1 S	CIL ITEM	
FLIGH HDW/FUI		A	В	С		
NASA [/ IOA [3 /1R] [1] P]	[] [P]	[] [P]		*
COMPARE [N /N] []	N]	[N]	[и]	[:	l
RECOMMENDATIONS:	(If di	fferent	from NAS	A)		
[3 /1R] []	P]	[P]	[P] (Al	[DD/DE	
* CIL RETENTION	RATIONALE	: (If a	pplicable)		
				ADEQUATE INADEQUATE	[]
REMARKS: IOA FAILURE MODE		CMD CH	N (1 OF 3) INOPERATI	VE.	
FMEA FAILURE MOD SINCE THIS FAILU OF FMEA 05-1-FC6 RECOMMEND THAT A	RE MODE M	H THE S	AME CRITI	CALITY (3/1)	R), I	NALYSIS OA DOES

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/23/87 GNC-1110 05-1-FC7) 7244-000	NASA DATA BASELINE NEW									
SUBSYSTEM: MDAC ID: ITEM:	GNC 1110 CIRCUIT-	-FCS CHN	CNTL									
LEAD ANALYST:	ROBERT C	DONNEL	L		,							
ASSESSMENT:												
		REDUNDA	NCY SCREE	:NS	CIL ITEM							
	FLIGHT HDW/FUNC A B C											
NASA [3 /1R IOA [3 /1R] [F] P]	[P] [P]	[P] [P]	[X] *							
COMPARE [/] [N]	[]	[]	[N]							
RECOMMENDATIONS:	(If di	fferent	from NAS	A)								
[3 /1R] [P]	[P]	[P]	[X] DD/DELETE)							
* CIL RETENTION I	RATIONALE	: (If a										
DEM DVC .				ADEQUATE INADEQUATE	[]							
INADEQUATE [] REMARKS: IOA FAILURE MODE: SWITCH CONTACT FAILS CLOSED (AT TRANSFER/PREMATURE). FMEA FAILURE MODE: FAILS TO TRANSFER. IOA DOES NOT CONCUR WITH NASA'S REEVALUATION AND RATIONALE FOR CHANGING SCREEN "A" FROM P (PASS) TO F (FAIL). SWITCH NORMALLY												
REMAINS IN AUTO I	POSITION	DURING (GROUND TU	RNAROUND TES	TING, AND IS							
FLIGHTS. THE CII RETENTION RATIONA CAPABLE OF CHECKO	L WAS NOT LLE. RED	AVAILAI C TNADNU	BLE FOR E'	VALUATION OF S SCREEN-A.	IF THEY ARE							

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/23/87 GNC-1111 05-1-FC7244-00	/23/87 NASA DA NC-1111 BASELI 5-1-FC7244-0001 N							
SUBSYSTEM: MDAC ID: ITEM:	GNC 1111 CIRCUIT-FCS CH	n CNTL							
LEAD ANALYST:	ROBERT O'DONNE	LL							
ASSESSMENT:									
FLIGH!				CIL ITEM					
HDW/FUI	NC A	В	C						
NASA [3 /1R IOA [3 /1R] [F]] [P]	[P] [P]	[P] [P]	[X] * []					
COMPARE [/] [N]	[]	[]	[N]					
RECOMMENDATIONS:	(If differen	t from NAS	SA)						
[3 /1R] [P]	[P]		[X] ADD/DELETE)					
* CIL RETENTION	RATIONALE: (If	applicable	e) ADEQUATE INADEQUATE	[]					
REMARKS: IOA FAILURE MODE OPEN OR SHORTED FMEA FAILURE MODE IOA DOES NOT CONCHANGING SCREEN REMAINS IN AUTO FUNCTIONALLY CHE FLIGHTS. THE CI RETENTION RATION	TO GROUND (AT TE: FAILS TO TRACUR WITH NASA'S "A" FROM P (PASPOSITION DURING CKED ONLY AFTER L WAS NOT AVAIL ALE. REDUNDANT	RANSFER/PRINSFER REEVALUATES) TO F (1) GROUND TO A SPECIFT ABLE FOR 1	REMATURE). TION AND RAT FAIL). SWIT URNAROUND TE IC NUMBER OF EVALUATION C SS SCREEN-A,	TIONALE FOR TCH NORMALLY ESTING, AND IS F OF THE , IF THEY ARE					

ASSESSME ASSESSME NASA FME	ENT	I	D:	GN	GNC-1111A BASEL 05-1-FC7244-0002											[]			
SUBSYSTE MDAC ID:				GN 11 CI		T-]	FCS	s ci	HN	Cì	VT	L									
LEAD ANA	LYS	ST	:	RO	BERT	0	DO	וממכ	ELI												
ASSESSME	NT	:																			
		F	ICAL LIGH W/FUI	r			REI	OUNI	DAN	IC?		SCRI	EEN	s c				IL PEN	4		
NASA IOA]	3 3	/1R /1R]		[]	[[}	[F	•]	[P P]		[x]	*	
COMPARE	[/]		[]	[]		[]	[]		[N]		
RECOMMEN	DAI	'I	ons:		(If d	dii	f€	rer	nt	fr	·O	m N <i>3</i>	\SA)							
	[3	/1R]		(E)		[F	•]	[P]	(Al		X /DE		ETE)	
* CIL RE													I	IAI	DEQUA	TE	[]		
IOA FAIL	CHU	ים יים	יי תאיי זטטע:	אכ	TICI	i C	NU: « / »	L'AC	T'	OR NG) : :::::::::::::::::::::::::::::::::::	CURE	(ENT		LIMIT	RES	SIS	STC	R	FAI]	٠.

IOA FAILURE MODE: SWITCH CONTACT OR CURRENT LIMIT RESISTOR FAILS OPEN OR SHORTED TO GROUND (AT TRANSFER/PREMATURE).

FMEA FAILURE MODE: SHORTED TO GROUND, OPEN, PREMATURE OPERATION.

IOA DOES NOT CONCUR WITH NASA'S REEVALUATION AND RATIONALE FOR CHANGING SCREEN "A" FROM P (PASS) TO F (FAIL). SWITCH NORMALLY REMAINS IN AUTO POSITION DURING GROUND TURNAROUND TESTING, AND IS FUNCTIONALLY CHECKED ONLY AFTER A SPECIFIC NUMBER OF FLIGHTS. THE CIL WAS NOT AVAILABLE FOR EVALUATION OF THE RETENTION RATIONALE. REDUNDANT ITEMS PASS SCREE-A, IF THEY ARE CAPABLE OF CHECKOUT DURING NORMAL GROUND TURNAROUND.

ASSESSME ASSESSME NASA FME	NT :	ID	:	1/23/8 GNC-11 05-60-	11		, PRE	ĿL	RE	EF NO.			ASA DA BASELI N		[) ()	
SUBSYSTEM MDAC ID:	M:			GNC 1111 CIRCUI	(T-	·FC	CS CHN	1 (CNI	'L							
LEAD ANA	LYS'	T:		ROBERT	0) ' [ONNEI	L									
ASSESSME	NT:																
			CAL:	TTY T		RE	EDUNDA	N	CY	SCREE	ENS	3			CII	_	
	H	DW	/FUI	1C		A			В			С					
NASA IOA	[3 3	/1R /1R]	[P P]	[P P]	[P P]		[]	*
COMPARE	[/]	[]	[]	[]		C]	
RECOMMEN	DAT	IO	NS:	(If	đi	.f1	ferent	: :	fro	om NAS	SA))					
	[/	1	[]	[]	[]	(AI] DELI	ETE)
* CIL RE	TEN	TI	ON 1	RATION	ALE	2:	(If a	ıpı	p 1:	icable			DEQUAT DEQUAT]	
REMARKS:	URE	M	ODE	: SWIT	CH	CC	ONTACT	ני (OR	CURRI	EN?	r 1	LIMIT	RES	sis:	ror	FAIL

IOA FAILURE MODE: SWITCH CONTACT OR CURRENT LIMIT RESISTOR FAILS OPEN OR SHORTED TO GROUND (AT TRANSFER/PREMATURE).
FMEA FAILURE MODE: 1.2K CURRENT LIMITING RESISTOR (FOR ATVC AND ASA PWR SUPPLY) FAILS OPEN, OUT-OF-TOLERANCE, OR SHORTED.
NO DIFFERENCES: THE OUT-OF-TOLERANCE AND SHORTED (ZERO RESISTANCE) FAILURE MODES WERE NOT CONSIDERED BY IOA SINCE THESE FAILURE MODES WOULD ALWAYS REFLECT A CRITICALITY OF 3/3. THE "OPEN" FAILURE REFLECTS THE WORST CASE CRITICALITY OF THE RESISTOR.

ASSESS NASA F	ME	TN	II	D:	GNC 05-	23/8 2-11 -60-	11	1C 08),	PR	EL	R	EF	NO.		N.	ASA BASE	DATA LINE NEV); [] []	x]	
SUBSYS MDAC I ITEM:	TEI D:	M:			GNO 111 CIF	2															
LEAD A	NA]	LYS	ST:	•	ROE	BERT	פ י	0'1	OO	INE:	LL										
ASSESS	MEI	NT:	:																		
	(FI	CAL:	ľ					JND	AN	CY	sc	CREE	NS	5			CII		
		F	IDW	I/FUI	1C			A				В				С					
NAS IO	A A	[3	/3 /1R]		[NZ P	A]]		[N/ P	A]] [NA P	A]]]	*
COMPAR	E	[/N]		(N]		[N]		[N]		[]	
RECOMM	ENI	ľAC	CIC	ns:	(Ιf	d:	ifi	fer	ent	t :	fro	om	NAS.	A))					
		[/	J		[]		[]		[]	(A	[DD/[ETE)
* CIL	REI	EN	ΙΤΙ	ON F	ITAS	ONA	LI	€:	(I	fa	ıpı	pl i	ica	ble)						
	_													:	IN			ATE ATE]	
REMARK IOA FA OPEN O FMEA F	ILU R S	HC	RT	'ED I	'O G	ROU	NI) (AT	TF	(AS	ISI	ER	/PR	EM	[A]	URE	١.			
SIGNAL THE OU	TC T-C) G)F-	PC TO) FA LERA	ILS NCE	OP AN	EN D	I, SE	OU IOR	T-C TEL)F-	-TC (ZE	LE	RAN	CE SI	ST	OR S	SHOR'	TED.	RE	MODES
WERE NO REFLECT WORST	ot Pa	CO	NS RI	TICA	ED LIT	ву Уо	IC F)A 3/	SI 3.	NCE T	r I	CHE	SE	FA: EN"	ΙÏ	JUR	E MC	DES	WOII	T.D	ATWAVE
IOA FA: OPEN W:	I LU I T H	RE	OR	ODE ST C	INC	LUD CR	EC II) A	LL	SW ITY	III ' C	CH F	C 3 /	ONT	FO	R	PREI	. FM	FA N	0 0	FAILED
(06). LIMITI REQUIR	NG NG	A RE	AG SI	REES	IN MI	TH TH	A E	OV	ER.	ICA RID	LI E	TY CH	O N.	F 3,	/3 VE	F RR	OR 1	POS	CURR	ENT N C	T NT.V
																	-				

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	GNC-1112	3), PREL		NASA DATA: BASELINE NEW							
SUBSYSTEM: MDAC ID: ITEM:		FCS CHN C	NTL								
LEAD ANALYST:	ROBERT O	DONNELL									
ASSESSMENT:											
FLIGH			Y SCREENS	3	CIL ITEM						
HDW/FU	NC .	A	В	С							
NASA [3 /3 IOA [3 /1R] [NA] [P] [NA] [P] [NA] P]	[] *						
COMPARE [/N] [и] [и] [и ј	[]						
RECOMMENDATIONS:	(If di	fferent f	rom NASA)								
[/] [] [] [[] DD/DELETE)						
* CIL RETENTION	RATIONALE	: (If app	•	ADEQUATE	[]						
ADEQUATE [] INADEQUATE [] REMARKS: IOA FAILURE MODE: DIODE FAILS OPEN. FMEA FAILURE MODE: DIODE OPEN BETWEEN FCS SWITCH OVERRIDE AND AUTO POSITIONS. AFTER NASA/RI REEVALUATION OF FMEA AND FURTHER IOA EVALUATION OF SYSTEM OERATION, IOA DOES CONCUR WITH THE NEW FMEA. IF DIODES FAIL OPEN, THE FCS CHN SWITCH IN OVERRIDE WILL REMOVE POWER FROM ASA/ATVC PWR SUPPLY AND ISSOLATE CHN FROM SYSTEM. OVERRIDE POSITION ONLY REQUIRED IF PREVIOUS FAILURES EXIST IN THE ASA/ATVC SYSTEM. FCS CHN SWITCH IN AUTO WILL RESTORE POWER TO THE RESPECTIVE ASA/ATVC.											

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #: SUBSYSTEM:	1/23/87 GNC-1130 05-60-200	NASA DATA BASELINE NEW										
SUBSYSTEM: MDAC ID: ITEM:	1130	ASA'S 1,2,		ER								
LEAD ANALYST:	ROBERT O	DONNELL										
ASSESSMENT:												
CRITICAL: FLIGHT	ITY F	REDUNDANCY	SCREENS	5	CIL							
HDW/FU	ITEM											
NASA [3 /1R IOA [3 /1R] [P	[P] [F] [P] [P] [P] [P]										
COMPARE [/] [] [N] []	[N]							
RECOMMENDATIONS:	(If dif	ferent fr	om NASA)									
[/] [] [] [] (AI	[] DD/DELETE)							
* CIL RETENTION F	RATIONALE:	(If appl	·	ADEQUATE ADEQUATE	[]							
REMARKS: IOA FAILURE MODE: POWER CIRCUIT FAILS OPEN (OFF), DURING POWER TRANSFER OR PREMATURELY. FMEA FAILURE MODE: OPEN - 12/35 AMP DIODE (TO PWR SUPPLY).												
AFTER NASA/RI REE SYSTEM OPERATION, REDUNDANT DIODE F FL OPN ARE DETECT CONTROL CHANNEL I	IOA DOES L OPN IS ABLE BY L	CONCUR WINOT DETECTORS OF PWI	ITH THE PABLE. R TO CHN	REVISED FM TWO REDUND . AND RESU	EA. ONE OANT DIODES ULTS IN							

EVALUATION OF THE RETENTION RATIONALE.

NASA DATA:

ASSESSME ASSESSME NASA FME	1/23/87 NASA DATA: GNC-1130A BASELINE [05-60-200703-1 NEW []																			
SUBSYSTE MDAC ID:				GNC 113 CIR		-A	SA	's	1,	2,3	3,4	PO	WI	ER						
LEAD ANA			:	ROB	ERT	0'	DO	NNE	LL											
ASSESSMI														_			6 T			
CRITICALITY FLIGHT						R	ED	UNE	AN	CY	SC	CREE	:NS	Š			CI			
	I	_				A				В				С						
NASA IOA	[3	/3 /1R]]	N	IA]		[NZ P	A]		[NA P	A]		[:]	*
COMPARE	[/N]	[N	[]		[N]		[N]		[]	
RECOMMEN	1DA'	ri:	ons:	([If d	if	fe	rer	ıt	fr	om	NAS	SA))						
	[/]	(}		[]		[]	(A)		DE:		TE)
* CIL RI	ere:	ΝΤ	ION :	RAT]	ONAI	E:	. (Ιf	ap	pl	ica	able	e)							
							•		•	•			I	IA IAN	DEQU <i>I</i>	TE TE	[]	
REMARKS: IOA FAI TRANSFEI FMEA FAI AFTER NI SYSTEM (DIODES) AND INH: FAILURE REDUNDAI	LUR R O ILU ASA OPE FAI IBI IS	R RE /R RA LI T D	PREM MOD I RE TION NG OTHE ETEC	ATUF E: (EVAI , I(PEN ASA TED.	RELY. PEN LUATI DA DO WILI FROM	- OES L (12 N C S C CAU	2/35 OF I CONC USE OLAT (CI	S A FME CUR TH FIN	MP A W E G	DI ANI ITI IS(THI	IODI D FU H TH OL V E CH SOL	E JR' IE VA IN V	(T(THI RI LVI	O ISC ER IC EVISI E DRI	OL V OA E ED F EVER ASA	LV VAL MEA TO SY	DR UA F	IV TI T AI	ER). ON OF THE L OFF

AS: AS: NA:	SESSMI SESSMI SA FMI	ATE:	C: 1/23/87 GNC-1130B 05-60-200706-1										A DA	INE] x]						
SUBSYSTEM: GNC MDAC ID: 1130 ITEM: CIRCUIT-ASA'S 1,2,3,4 POWER LEAD ANALYST: ROBERT O'DONNELL																						
LEA	AD AN	ALY	ST	:	RO	BERT	(ויכ	DON	NELI												
ASS	SESSME	ENT	:																			
	CRITICALITY FLIGHT							RI	EDU	NDAN	CY	s	CRE	EN	S				CI			
	HDW/FUNC														С				IT	EM		
	NASA IOA	[3 3	/3 /1R]] [N# P	A]	[N P	A]]	NA P	A]			[]	*	
COM	IPARE	[/N]		[N]	[N]		[N]			[]		
REC	OMMEN	ID A '	ri	ons:		(If o	di	ff	ere	∍nt	fr	om	NA	SA)							
		[/]	1	[]	[]		[]		(AI	[DD/I) DELI	ETF	E)
	IL RE		VT]	ION F	TAS:	IONAI	LE	:	(Ii	ap	pl	ic	able				UAT UAT		[]		
IOA TRA	FAIL NSFER A FAI	URI	1	'KEMP	TUI	KELY.																
AFT SYS RPC AND FAI	VER). ER NA TEM O 'S FA INHI LURE UNDAN	SA/ PEF ILI BIT IS	RI RAI INC INC I	REE TION, OPE THE A	VAI IC N V SA 'ED.	LUATI DA DO VILL FROM	IO C I	N S AU IS	OF CON SE OLA	FME CUR THE TING	A 2 W: IS G 7	ANI CTH SOI CHI	D FU H TH L VA E CH	JRI HE ALV IN VI	HE RE	R I	IOA SED IVE:	EV FM R I	ALU EA.	ATI T AII	ON	OF

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/23/87 GNC-1130C 05-60-(14), PREL REF NO.	NASA DATA: BASELINE [] NEW [X]								
MDAC ID.	GNC 1130 CIRCUIT-ASA'S 1,2,3,4 PO	WER								
LEAD ANALYST:	ROBERT O'DONNELL									
ASSESSMENT:										
FLIGH	ITY REDUNDANCY SCREE T NC A B	ITEM								
	[P] [F]									
COMPARE [N /] [] [N]	נא) נא								
RECOMMENDATIONS:	(If different from NAS	A)								
[/] [] []	[] [] (ADD/DELETE)								
	RATIONALE: (If applicable) ADEQUATE [] INADEQUATE []								
REMARKS: IOA FAILURE MODE: POWER CIRCUIT FAILS OPEN (OFF), DURING POWER TRANSFER OR PREMATURELY. FMEA FAILURE MODE: ASA POWER SW FAILS TO TRANSFER (OPEN). AFTER NASA/RI REEVALUATION OF FMEA AND FURTHER IOA EVALUATION OF SYSTEM OPERATION, IOA DOES CONCUR WITH THE NEW FMEA. WITH 2 ASA PWR SWITCHES FAILED TO TRANSFER (OPEN), THERE WILL EXIST A 2 ON ASA CHN FORCE FIGHT WHICH COULD RESULT IN LOSS OF VEHICLE CONTROL. LOSS OF SWITCH IS NOT READILLY DETECTABLE, BUT THE RESULTING LOSS OF RPC PWR AND ASA CHN IS DETECTABLE. LOSS OF										

ISOL VLV DRIVER PWR NOT DETECTABLE. THE CIL WAS NOT AVAILABLE

FOR EVALUATION OF THE RETENTION RATIONALE.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/23/87 GNC-1130D 05-60-(15),	PREL REF 1	NASA DASELA	ATA: INE [] NEW [X]										
SUBSYSTEM: MDAC ID: ITEM:	GNC 1130 CIRCUIT-ASA'	1130 CIRCUIT-ASA'S 1,2,3,4 POWER												
LEAD ANALYST:	ROBERT O'DON	NELL												
ASSESSMENT:														
FLIGH				CIL ITEM										
	NC A		С											
NASA [3 /1R IOA [3 /1R] [P]] [P]	[F] [P]	[P] [P]	[X] * []										
COMPARE [/] []	[и]	[]	[и]										
RECOMMENDATIONS:	(If differ	ent from N	ASA)											
[/] []	[]	[]	[] (ADD/DELETE)										
* CIL RETENTION :	RATIONALE: (I:	f applicab	le) ADEQUAT INADEQUAT	'E [] 'E []										
IOA FAILURE MODE TRANSFER OR PREMA FMEA FAILURE MODE PREMATURE OPERAT	ATURELY. E: ASA POWER S ION.	SW POLE (C	ONTACT) FAI	LS OPEN, SHORT,										
AFTER NASA/RI REEVALUATION OF FMEA AND FURTHER IOA EVALUATION OF SYSTEM OPERATION, IOA DOES CONCUR WITH THE NEW FMEA. FOR PWR SW WORST CASE, 2 CONTACT FAIL OPEN (LOSS OF ISOL DRIVER), 2 CONT FAIL OPEN (LOSS OF														
PWR SUPPLY WITHOUT CHN ISOLATION). LOSS OF CONTACTS ARE NOT READILY DETECTABLE, BUT THE RESULTING LOSS OF RPC PWR AND ASA CHN IS DETECTABLE. ASA CHN-4 ISOL VALVE DRIVERS NOT REDUNDANTLY POWERED LIKE CHN 1, 2, 3. LOSS OF ISOL VLV DRIVER PWR NOT DETECTABLE. THE CIL WAS NOT AVAILABLE FOR EVALUATION OF THE RETENTION RATIONALE.														

ASSESSMENT DATE: 1/23/87 ASSESSMENT ID: GNC-1130E NASA FMEA #: 05-60-(16), PREL REF NO									ο.	NA E	SASEI	ATA: LINE NEW	[x]		
SUBSYSTEM MDAC ID:	1:		GNC													
LEAD ANAI	YST	:	ROBER	ר כ	ם י כ	ONNEI	L									
ASSESSMEN	T:															
C	FI	T.TCH	ITY F NC							EENS				CIL		
NASA IOA	[3	/3 /1R]	[NA P]	[NZ P	A]	[NA P	A]		[]	*
COMPARE	[/N]	[N]	[N]	[N]		[]	
RECOMMENI	OITAC	ONS:	(If	d:	iff	erent	: 1	fro	om N	(ASA))					
	[/]	[]	[]	[]		[DD/D:		ETE)
* CIL RET		ION 1	RATION	AL	€:	(If a	apj	pl:	icab	ole) II	AI IAN	DEQUI	ATE ATE	[]	
REMARKS: IOA FAIL TRANSFER FMEA FAIL VALVE DRI THE OUT-O WERE NOT REFLECT A WORST CAS WAS POWER WITH WORS SYSTEM OF THE RESIS POWER.	URE I OR I LURE IVER OF-TC CONS A CRI R CI R CI PERA	PREM MOD PWR OLER SIDE ITIC RITI RCUI ASE TION	ATUREL E: 1.2) FAIL ANCE A RED BY ALITY CALITY T FAIL CRITIC , IOA	Y. K ND OF OF AL	CUF OPE OA 3/ F T OPE ITY	RRENT EN, OU HORTEI SINCE CHE RE EN (RE CONCE	LI JT C E THI ESI PC JR	IM: (Z) (TH) E 'S IS' 1R	ITIN F-TC ERO ESE "OPE FOR. , DI	IG RICLER RESIDENT ICODE:	ESI ANG ISI LUI FAI OA S,	ISTOI CE, (TANCI RE MO ILURI FAL: AND FURTI RITIO	R (FC OR SH E) FA ODES E REH IURE SWITHER H	OR A HORTALLUMOUS MOUNTED MODICH	SA ED. RE LD TS E CIH UAT	ISOL MODES ALWAYS THE RCUIT)

ASSESSMENT DAT ASSESSMENT ID: NASA FMEA #:	GNC-11'	ROF	REL REF NO	NASA DATA BASELINE NEW	A: E [] V [X]						
SUBSYSTEM: MDAC ID: ITEM:											
LEAD ANALYST:	ROBERT	O'DONNE	LL								
ASSESSMENT:											
	ALITY GHT	REDUND	ANCY SCRE	EENS	CIL						
HDW/	С	ITEM									
NASA [3 / IOA [3 /	IR] [P]	[P] [P]	[P] [P]	[] *						
COMPARE [/] []	[]	[]	[]						
RECOMMENDATION	S: (If d	lifferen	t from NA	SA)							
[/] []	[]		[] DD/DELETE)						
* CIL RETENTION	RATIONAL	E: (If	applicabl	•							
DEM DVG				ADEQUATE INADEQUATE	[]						
REMARKS: IOA FAILURE MOI	E: POWER	CIRCUIT	FAILS OP	EN (OFF), DU	RING POWER						
TRANSFER OR PREMATURELY. FMEA FAILURE MODE: RPC FAILS OPEN OR PREMATURE OPERATION (TO ASA											
PWR SUPPLY). NO DIFFERENCES IN NASA/IOA ASSESSMENT OF NEW FMEA. ONE REDUNDANT RPC FL OPEN IS DETECTABLE ON INSTRUMENTATION. TWO REDUNDANT RPC'S											
FAIL OPEN ARE	DETECTABLE ETECTABLE	LE ON IN	STRUMENTA! ESULTS IN	TION. TWO RE	DUNDANT RPC'S NNET.						

ISOLATION.

ASSESSME	ENT DATE: ENT ID: EA #:		31		NASA DAT BASELIM NI]				
SUBSYSTEMDAC ID:		GNC 1131 CIRCUI	T-ASA'S	1,2,3,4 I	POWER						
LEAD ANA	ALYST:	ROBERT	O'DONNE	LL							
ASSESSMI	ent:										
	CRITICAL FLIGH		REDUND	ANCY SCRE	EENS	CIL ITE					
		NC	A	В	С	*****	•				
NASA IOA	[/ [3 /3]	[] [NA]	[] [NA]	[] [NA]	[] *				
COMPARE	[N /N]	[N]	[N]	[N]	[]				
RECOMME	NDATIONS:	(If	differen	t from NA	ASA)						
	[3 /3	1	[NA]	[NA]	[NA]	[(ADD/D] ELETE)				
* CIL R	ETENTION	RATIONA	LE: (If	applicab:		_	_				
					ADEQUATI	3 (8 (]				
IOA FAII TRANSFEI FMEA FA	REMARKS: IOA FAILURE MODE: POWER CIRCUIT FAILS CLOSED (ON), DURING POWER TRANSFER OR PREMATURELY. FMEA FAILURE MODE: NA										
AFTER TI	MEA FAILURE MODE: NA FTER THE FMEA REVIEW, NASA/RI DID NOT COVER THIS FAILURE MODE. OA DOES RECOMMEND WRITING A NEW FMEA FOR COMPLETENESS.										

	ASSESSMENT DATE: 3/20/87 ASSESSMENT ID: GNC-120 NASA FMEA #: 05-1-F0								42-1	L							DATA LINE NEW	[
]	SUBSYSTEM: GNC MDAC ID: 1201 ITEM: RJDF LEAD ANALYST: TRAHAN																					
٠	LEAD AN	ALY	ST	':	TR	AHAI	Ν,	W.	. н.	•												
1	ASSESSMI	ENT	!:																			
		CR		'ICAL				RI	EDUN	IDA	NC	CY	SCF	REEN	s				IL TE			
				W/FUI				A				В			С			*				
	NASA IOA	[2	/1R /1R]		[P P]		[P P]	[P P]		[X]	*	
(COMPARE	[N	/]		[]		[]	[]		[N]		
]	RECOMME	NDA	TI	ons:		(If	d:	ifi	fere	ent	1	fro	om N	IASA)							
		[/]		[]		[]	[]] ELI		Ε)
7	* CIL RI	ETE	NT	ION I	RAT:	IONA	\LI	€:	(If	a j	pŗ	oli	cab	ole)	Δι	DEOU	ATE	г	Y	7		
1	REMARKS:	,												I	NAI	DEQU	ATE	[А]		
	IOA FAII	LUR																				
]	FMEA FAI FAILURE	WI	LL	BE I	DET!	ECTE	ED	BY	RM ?		J	ΓΞΊ	WI	E O	R 1 NO:	ORE BE	JET: SELI	S. EC:	ΓEI	٥.	C	THER
Č	JETS CAN ADDITION	I P	ER.	FORM	TH	E DE	ES]	ERE	ED F	UNO	CI	'IC	N.									
2	AGREEIN	W	IT	H THE	E NZ	ASA	FI	1EA	FO	R	CH	ΙE	WOR	ST	CAS	SE L	oss (OF.	FV	۸D	RC	:s
- 1	DUMP CAI	·AB	ىلىد	TTY.																		

ASSESSMENT DATE: 3/20/87 ASSESSMENT ID: GNC-120 NASA FMEA #: 05-1-FC								2-1]		SA DATA ASELINE NEW	[
SUBSYSTEM MDAC ID:																		
LEAD ANA	LYS	T:		TR	AHAN	,	W.	н.										
ASSESSME	NT:																	
CRITICALITY FLIGHT								REDUNDANCY SCREE								CIL TEM		
FLIGHT HDW/FUNC							A			В			С					
NASA IOA	[3	/1R /1R]		[P P]	[P P]	[P P]	[]	*
COMPARE	[/]		[]	[]	[]	[]	
RECOMMEN	DA'	ric	ons:		(If	d:	iff	erent	= :	fro	om NAS	SA)						
	[/]		[]	[]	[] (2		[D/ D E		TE)
* CIL RE	TEI	T	ION	RAI	'ION	AL I	E:	(If a	ąp	pl:	icable	∍) IN	AI IAI	DEQUATE DEQUATE		[]	
ADEQUATE [] INADEQUATE [] REMARKS: IOA FAILURE MODE: NO OUTPUT. FMEA FAILURE MODE: LOSS OF OUTPUT TO ONE OR MORE JETS. FAILURE WILL BE DETECTED BY RM. THE JET WILL NOT BE SELECTED BY THE SOFTWARE. OTHER JETS CAN PERFORM THE FUNCTION. NO DIFFERENCES.																		

ASSESSMENT DATE ASSESSMENT ID: NASA FMEA #:	GNC-120	7 05 06342-2		nasa da Baseli N							
SUBSYSTEM: MDAC ID: ITEM:	GNC 1205 RJDA										
LEAD ANALYST:	TRAHAN,	W. H.									
ASSESSMENT:											
CRITICA: FLIGH		REDUN	DANCY SCRI	EENS	CIL ITEM						
HDW/FU	INC	A	В	С							
NASA [1 /1 IOA [1 /1] [P] P]	[P] [P]	[P] [P]	[X] * [X]						
COMPARE [/] []	[]	[]	[]						
RECOMMENDATIONS:	(If d	iffere	nt from NA	SA)							
[/] []	[]		[] (ADD/DELETE)						
* CIL RETENTION	RATIONAL	E: (If	applicabl	e) ADEQUATI INADEQUATI							
REMARKS: IOA FAILURE MODE: INADVERTENT JET FIRING. FMEA FAILURE MODE: ERRONEOUS OUTPUT. IO DIFFERENCES.											

ASSESSMENT DATE ASSESSMENT ID: NASA FMEA #:		6		NASA DATA: BASELINE [] NEW [X]								
SUBSYSTEM: MDAC ID: ITEM:	GNC 1206 RJDF											
LEAD ANALYST:	TRAHAN,	W. H.										
ASSESSMENT:												
CRITIC FLI HDW/		REDUND A	ANCY SCRE	ENS C	CIL ITEM							
•	1] [1] [[P] [P]	[P] [P]	[X] *							
COMPARE [/] []	[]	[]	[]							
RECOMMENDATION	s: (If d	lifferen	t from NA	ASA)								
[/] [. 1	[]	[]	[ADD/DELETE)							
* CIL RETENTIO	N RATIONAL	Æ: (If	applicabl	le) ADEQUATE INADEQUATE								
REMARKS: IOA FAILURE MODE: INADVERTENT JET FIRING. FMEA FAILURE MODE: ERRONEOUS OUTPUT. NO DIFFERENCES.												

ASSESSMENT DATA ASSESSMENT ID: NASA FMEA #:				NASA DATA BASELINI NEV							
SUBSYSTEM: MDAC ID: ITEM:	GNC 1207 PC FEEI	DBACK									
LEAD ANALYST:											
ASSESSMENT:											
	ALITY GHT	REDUNDAN	NCY SCRE	ENS	CIL ITEM						
HDW/	FUNC	A	В	С							
NASA [/ IOA [3 /] [LR] [[] [[P] [P]	[] [P]	[] *						
COMPARE [N /	4] [[и]	[и]	[N]	[]						
RECOMMENDATION	3: (If d	lifferent	from NA	SA)							
[3 /	LR -] [[P] [Pj		[] NDD/DELETE)						
* CIL RETENTIO	RATIONAL	E: (If ap	plicabl	e)							
ADEQUATE [] INADEQUATE []											
REMARKS: IOA FAILURE MODE: ERRONEOUS OUTPUT. (RJDF) FAILURE WILL BE DETECTED BY RM. JET WILL NOT BE SELECTED. OTHER JETS CAN PERFORM THE DESIRED FUNCTION. IOA RECOMMENDS A FMEA BE WRITTEN FOR COMPLETENESS.											

ASSESSMENT DATE: 3/20/8/ ASSESSMENT ID: GNC-120 NASA FMEA #: NONE							3							BASELINE NEW]	
SUBSYSTE MDAC ID: ITEM:					GNC 1208 PC FEE	EDI	BAC	CK									
LEAD ANA	ALY:	ST	:		TRAHAN	Ι,	W.	н.									
ASSESSMI	ENT	:															
	CR				TY		RI	EDUND	AN(CY	SCR	EENS	3		CIL		
]		LIGI V/FU		ic		A			В			С		411	• •	
NASA IOA	[3	/11	R]	[P]	[P]] [P]	[]	*
COMPARE	[N	/N]	[N]	[N]	[N]	[]	
RECOMME	NDA	TI	ONS	:	(If	d.	if	feren	t:	fro	om N	IASA))				
	[3	/1	R]	[P]	(P]	[P]	[.		TE)
* CIL R		NT:	ION	F	RATION	AL	E:	(If	ap)	pl:	icab	ole) IN	AI IAI	DEQUATE DEQUATE	[]	
REMARKS IOA FAII FAILURE JETS CAI WRITTEN	LUR WI N P	LL ER	BE FOR	I M	DETECTION OF THE DI	ED ES	B: IR	Y RM.		JE:	C WI	LLL 1	NO!	r be sei Recommen	ECTE	D C	THER EA BE

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	GNC-121	1		NASA DATA BASELINE NEW	
MDAC ID:	GNC 1211 POWER C	IRCUIT			
LEAD ANALYST:	TRAHAN,	W. H.			
ASSESSMENT:					
CRITICAL FLIGH		REDUNDA	ANCY SCRE	ENS	CIL ITEM
HDW/FU	NC	A	В	С	
NASA [/ IOA [3 /3] [NA]	[] [NA]	[] [NA]	[] *
COMPARE [N /N] [N]	[N]	[N]	[]
RECOMMENDATIONS:	(If d	ifferen	t from NAS	SA)	
[3 /3] [NA]	[NA]		[] DD/DELETE)
* CIL RETENTION	RATIONAL	E: (If a	applicable	∍)	
REMARKS:				ADEQUATE INADEQUATE	
IOA FAILURE MODE	: CIRCUI	r Fail (CLOSE (INA	ADVERTENT OUT	PUT) RJDF
IOA DOES RECOMME	ND WRITI	NG A FMI	EA FOR CON	IPLETENESS.	

ASSESSMENT ASSESSMENT NASA FMEA	ID:	GNC-1212		NASA DATA: BASELINE NEW]	
SUBSYSTEM: MDAC ID: ITEM:		GNC 1212 POWER C	IRCUIT				
LEAD ANALY	YST:	TRAHAN,	w. H.				
ASSESSMENT	r:						
CF	RITICAL FLIGH		REDUNDA	NCY SCREE	ns	CIL	f
		NC	A	В	С		-
NASA IOA	[/ [3 /3] [NA]	[] [AN]	[] [NA]	[] *
COMPARE	(N /N] [N]	[и]	[N]	[]
RECOMMENDA	ATIONS:	(If d	ifferent	from NAS	A)		
l	[3 /3] [NA]	[NA]	[NA] (A	[DD/DI] ELETE)
* CIL RETI	ENTION	RATIONAL	E: (If a	pplicable	ADEQUATE	[]
IOA FAILU	RE MODE	: CIRCUI	T FAIL C	LOSE (INA A FOR COM	DVERTENT OU	TPUT	RJDA.

ASSESSMI ASSESSMI NASA FMI	ENT	I	D:	3/20/ GNC-1 NONE											DATA ELINE NEW	[]
SUBSYSTI MDAC ID ITEM:				GNC 1213 POWER	C:	IRO	CUI	r									
LEAD AND	ALY	ST	:	TRAHA	N,	W	. н	•									
ASSESSMI	ASSESSMENT:																
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM HDW/FUNC A B C																	
		יטת	m/ FU	NC		A				В			C				
NASA IOA	[3	/ /1R]	[P]] [P]	[[P]		[] *]
COMPARE	[N	/N]	[N]		[N]	[N]		[1
RECOMMEN	IDA'	TI	ons:	(If	đ	iff	fere	ent	1	fro	om N	IASA)					
	[/]	[]		[]	[]	(AI	[DD/DI] ELETE)
* CIL RE	TE	NT:	ION 1	RATION	ALI	E:	(If	f a	þķ	oli	.cab	•		_	JATE JATE	[]
REMARKS: IOA FAII THIS ASS	UR	E I	MODE:	CIRCU	JI]	r F	'AII) ED	PE	EN EV	(NC	OUI	PĮ.	JT)	RJDA.		•

ASSESSMEN ASSESSMEN NASA FME	NT DA NT II A #:	ATE:	3/20/8 GNC-12 NONE	37 214	l.								DATA: LINE NEW]	
SUBSYSTEM MDAC ID: ITEM:			GNC 1214 POWER	C	[RC	UIT										
LEAD ANA	LYST	:	TRAHAI	Ν,	W.	н.										
ASSESSME	NT:															
			ITY		RE	DUNI	DANC	CY	SCR	EENS	;			CIL		
		LIGH' W/FU	NC T.		A			В			С			111	iri	
NASA IOA	[3	/ /1R]	[P]	[P]]	P]		[] *	
COMPARE	[N	/N	1	[N]	[N]	[N]		[]	
RECOMMEN	DATI	ons:	(If	d :	ifi	fere	nt i	Ero	om N	(ASA						
	[/] ·	[]	[]	[]	(Al] ELETE)	
* CIL RE		ION :	RATION	ΑL	E:	(If	apı	p1:	icab	ole) IN	IA IAI	DEQU DEQU	JATE JATE	[]	
REMARKS: IOA FAIL THIS ASS	URE	MODE ENT	: CIRC	UI' NG	r i	FAIL	OPI ED I	EN BY	(NC	OMS	rpt 5/1	JT) RCS	RJDF SUBS	YSTI	em Groui	₽.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	NASA DAT. BASELIN NE]					
SUBSYSTEM: MDAC ID: ITEM:	GNC 1301 ATVC							
LEAD ANALYST:	ROBERT	O'DON	NELL					
ASSESSMENT:								
CRITICAL FLIGH	CIL							
HDW/FU	NC	A	В	С				
NASA [/ IOA [3 /1R] [[] P]	[] [P]	[] [P]	[] *		
COMPARE [N /N] [N]	[N]	[N]	[]		
RECOMMENDATIONS:	(If d	liffer	ent from N	ASA)				
['3 /1R] [P]	[P]		[ADD/D] ELETE)		
* CIL RETENTION	RATIONAL	Æ: (I	f applicab	le) ADEQUATE INADEQUATE	[]		
REMARKS: IOA FAILURE MODE FMEA FAILURE MOD			OFF IN ON	E CHN.	-	-		
IT IS NOT CLEAR	THAT NAS	A/RI	COVERED TH	IS FAILURE MO	DE I	N FMEA		
05-1-FC6542-2 (ERRONEOUS OUTPUT) CRIT - 3/1R. RECOMMEND NASA/RI PROVIDE ADDITIONAL INFORMATION IN FMEA TO CLARIFY FAILURE MODES ANALYZED. IOA DOES RECOMMEND THAT A NEW								
FMEA BE WRITTEN FOR COMPLETENESS. THE ISOL CMD FL OFF WILL INHIBIT THE ISOLATION OF THE CHN IF AN ATVC SYSTEM FAILURE IS DETECTED.								

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	GNC-1302			BASELINE NEW]
	GNC 1302 ATVC					
LEAD ANALYST:	ROBERT O'I	DONNELL				
ASSESSMENT:						
CRITICALI FLIGHT HDW/FUR	C		Y SCREENS	c c	CIL	ſ
NASA [/ IOA [3 /1R] [P] [p] [P]	[] *
COMPARE [N /N] [N] [и] [N]	[]
RECOMMENDATIONS:	(If dif	ferent f	rom NASA))		
[3 /1R] [P] [P] [P] (AI	[DD/DE] ELETE)
* CIL RETENTION I	RATIONALE:	(If app	olicable) Il	ADEQUATE NADEQUATE	[]
REMARKS: IOA FAILURE MODE: FMEA FAILURE MODE IT IS NOT CLEAR	E: NONE. THAT NASA/1	RI COVER	OR ONE CE	HN. FAILURE MOI		
05-1-FC6542-2 (EI RECOMMEND NASA/RI CLARIFY FAILURE I	I PROVIDE A MODES ANAL	ADDITION YZED. I	IAL INFORM OA DOES M	MATION IN H	FMEA THAT	TO A NEW

ASSESSME ASSESSME NASA FME	ENT ENT EA	D. I! #:	ATE: D:	1/23/87 NASA DATA: GNC-1303 BASELINE [] 05-1-FC6542-1 NEW [X]													
SUBSYSTE MDAC ID:	EM:			GNC 1303 ATVC													
LEAD ANA	LY	ST	:	ROBER	r (0'1	ONNEL	L									
ASSESSME	NT:	:															
	CR:	ET: FI	ICALI LIGHT	ITY I IC		RI A	EDUNDA	N	CY B	SCREE	ENS	c		CI	_		
NASA IOA	[2 2	/1R /1R]	[P P]] [F P]	[P P]	[X X]	*
COMPARE	[/]	[]	[N]	[]	[]	
RECOMMEN	'DA'	ric	ons:	(If	d:	iff	erent	. 1	fro	om NAS	A)						
	[/	1	[1	[]]			[)D/			TE)
* CIL RE	TEN	T	ON F	RATIONA	L	Ξ:	(If a	pr	ol i		_	AC IAC	EQUATE EQUATE	[[x]	
REMARKS: TOA FAILURE MODE: NO POSITION CMD TO ACTR CHN (NULL OUTPUT). TMEA FAILURE MODE: LOSS OF OUTPUT. TOA DOES CONCUR WITH NASA'S REEVALUATION AND RATIONALE AS SHOWN THE NASA/JSC FMEA REVIEW COMMENTS. DUAL NULL FAILURES (ASA TOSS OF OUTPUT) OF ACTUATOR POSITION COMMANDS WILL BE UNDETECTED TO THE ATVC DELTA P FAULT DETECT CIRCUIT AND MCC MONITORING SYSTEMS WHILE ENGINES ARE NEAR ZERO ENGINE GIMBAL POSITION. THE TWO UNDETECTED NULL FAILURES, DURING ASCENT, WILL TAUSE A 2 ON 2 CHANNEL FORCE FIGHT AND MAY RESULT IN LOSS OF WEHICLE. TOA DOES NOT RECOMMEND A CHANGE TO THE EXISTING FMEA REDUNDANCY SCREEN B.																	

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/23/87 GNC-1304 05-1-FC6542-	/23/87 NASA DAT NC-1304 BASELIN 5-1-FC6542-2 NE							
SUBSYSTEM: MDAC ID:	GNC								
LEAD ANALYST:	ROBERT O'DON	INELL							
ASSESSMENT:									
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM HDW/FUNC A B C									
NASA [3 /11 IOA [2 /11	R] [P]	[P] [[P] [P] P]	[] *					
COMPARE [N /] []	[] []	[]					
RECOMMENDATIONS	: (If differ	rent from NASA)						
[/] []	[] [[] DD/DELETE)					
* CIL RETENTION	RATIONALE: (If applicable) I	ADEQUATE NADEQUATE	[]					
REMARKS: IOA FAILURE MODE: ERRONEOUS POSITION CMD TO ACTR. FMEA FAILURE MODE: ERRONEOUS OUTPUT. IOA DOES CONCUR WITH NASA'S REEVALUATION AND RATIONALE AS SHOWN IN THE FMEA REVISIONS. IF FAILURES ARE PRESENT DURING PRELAUNCH, WHEN ATVC FAULT DETECT IS INHIBITED, LAUNCH HOLD WILL BE INITIATED PRIOR TO SRB IGNITION. AS A RESULT OF NASA'S REVISIONS AND FURTHER IOA ATVC FAILURE ANALYSIS, IOA DOES NOT RECOMMEND A CHANGE TO THE EXISTING FMEA.									

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	GNC-130	,)5		NASA DAT BASELIN NE						
SUBSYSTEM: MDAC ID: ITEM:	GNC 1305 ATVC									
LEAD ANALYST:	ROBERT	O'DONNE	LL							
ASSESSMENT:										
CRITICAL FLIGH		REDUND	ANCY SCRE	ENS	CIL ITEM					
HDW/FU	NC	A	В	С						
NASA [/ IOA [3 /1R] [P]	[] [P]	[] [P]	[] *					
COMPARE [N /N] [N]	[N]		[]					
RECOMMENDATIONS:	(If d	ifferen	t from NA	SA)						
[3 /1R] [P]	[P]		[] ADD/DELETE)					
* CIL RETENTION	RATIONAL	E: (If	applicabl							
				ADEQUATE INADEQUATE	[]					
REMARKS: IOA FAILURE MODE: NO OUTPUT/ERRONEOUS OUTPUT ON ONE SEC DELTA F FDBK XDCR CHN. FMEA FAILURE MODE: NONE. IT IS NOT CLEAR THAT NASA/RI COVERED THIS FAILURE MODE IN FMEA										
O5-1-FC6542-2, CF FMEA BE WRITTEN I	KIT - 3/1	LR. TH	E IOA DOE:	S FAILURE MO S RECOMMEND	DE IN FMEA THAT A NEW					

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/23/87 GNC-1310 05-60-20	0 00601 - 1		NASA DATA: BASELINE NEW					
	GNC 1310	- ATVC'S 1)WER					
LEAD ANALYST:	ROBERT	O'DONNELL							
ASSESSMENT:									
CRITICAL FLIGH	CIL ITEM								
HDW/FU	NC	A	В	С					
NASA [3 /1R IOA [3 /1R] [P] [P] [F] [P] [P] P]	[X] *				
COMPARE [/] [] [и][]	[и]				
RECOMMENDATIONS:	(If d	ifferent :	from NASA)	ı					
[/] [] [] [[] DD/DELETE)				
* CIL RETENTION	RATIONAL	E: (If ap)		ADEQUATE NADEQUATE	[]				
REMARKS: IOA FAILURE MODE: POWER CIRCUIT FAILS OPEN (OFF), DURING POWER TRANSFER OR PREMATURELY. FMEA FAILURE MODE: OPEN - 12 AMP DIODE (TO POWER SUPPLY). AFTER NASA/RI REEVALUATION OF FMEA AND FURTHER IOA EVALUATION OF SYSTEM OPERATION, IOA DOES CONCUR WITH THE REVISED FMEA. ONE REDUNDANT DIODE FL OPN IS NOT DETECTABLE. TWO REDUNDANT DIODES FL OPN ARE DETECTABLE BY LOSS OF PWR TO CHN, AND RESULTS IN CONTROL CHANNEL ISOLATION. THE CIL WAS NOT AVAILABLE FOR EVALUATION OF THE RETENTION RATIONALE.									

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/23/87 GNC-131 05-60-2	1/23/87 NASA DATA GNC-1310A BASELINE 05-60-200602-1 NEW								
SUBSYSTEM: MDAC ID: ITEM:	1310	- ATVC'S	POWER							
LEAD ANALYST: ROBERT O'DONNELL										
ASSESSMENT:										
CRITICAL FLIGH HDW/FU	T	REDUNDA A	NCY SCREE	ens C	CIL ITEM					
NASA [3 /3 IOA [3 /1R] [NA] P]	[NA] [P]	[NA] [P]	[] *					
COMPARE [/N] [N]	[N]	[N]	[]					
RECOMMENDATIONS:	(If d	ifferent	from NAS	A)						
[/] []	[]		[] DD/DELETE)					
* CIL RETENTION REMARKS:	RATIONAL	E: (If a	pplicable	ADEQUATE	[]					
IOA FAILURE MODE	: POWER	CIRCUIT	FAILS OPE	N (OFF), DUI	RING POWER					

TRANSFER OR PREMATURELY.

FMEA FAILURE MODE: LOSS OF OUTPUT - RPC (TO ISOL VLV DRIVER). AFTER NASA/RI REEVALUATION OF FMEA AND FURTHER IOA EVALUATION OF SYSTEM OPERATION, IOA DOES CONCUR WITH THE REVISED FMEA. THE RPC'S FAILING OPEN WILL CAUSE THE ISOL VALVE DRIVER TO FAIL OFF AND INHIBIT THE MPS ATVC FROM ISOLATING THE CHN IF AN MPS ATVC SYSTEM FAILURE IS DETECTED. ISOL VALVE DRIVERS NOT REDUNDANTLY POWERED IN EACH ATVC (CHN).

ASSESSMEN ASSESSMEN NASA FME	VT DA VT II A #:	ATE: D:	1/23/ GNC-1 05-60	87 310E -(07), PR	EL I	REF N	N 0.	ASA I BASEI	LINE	[]	
SUBSYSTEM MDAC ID:	4:		GNC 1310 CIRCU	IIT-	ATVC!	s 1	,2,3,	4 POW	ER				
LEAD ANA	LYST	:	ROBER	T O'	DONNE	ELL							
ASSESSME	T:												
•			ITY I	F	REDUNI	DANC	Y SCR	EENS			CIL		
			NC	7	.		В	C	!				
NASA IOA	[3	/3 /1R]	[] []	IA] P]	[NA] P]	[N [P	[A]		[]	*
COMPARE	[/N]	[]	1]	[и]	[N]		[]	
RECOMMEN	DATI	ons:	(If	di	fferer	nt f	rom N	ASA)					
	[/]	[]	[]	[]	(AI	[DD/D		ETE)
* CIL RE		ION 1	RATION	VALE:	: (If	app	licab	ole) A INA	DEQUA	ATE ATE	[]	
IOA FAIL TRANSFER FMEA FAI ISOL VAL THE OUT- WERE NOT REFLECT WORST CA WAS POWE WITH WOR SYSTEM O THE RESI DRIVER P THE CHN	URE OR LURE VE D OF-T CON A CR SE C R CI ST C PERA STOR	PREM MOD RIVE OLER SIDE ITIC RITI RCUI ASE TION	ATUREI E: 1.2 R PWR) ANCE 1 RED BY ALITY CALITY CRITIC , IOA LING (HE ISO	LY. 2K CV FAI AND S OF S OF S CALIS DOES OPEN OL CI	JRRENT ILS OF SHORTH A SING THE I PEN (I PEN	F LI PEN, ED (CE T THE RESI RPC' 3/1 CUR LOS OFF	MITIN OUT- ZERO HESE "OPE STOR. S, DI R. A WITH S OF WILL	G RESISTALLUM FAILUM FA	CISTOL CLERAL CTANCE CRE MO ALURE AND FURTE CRITIC VALVE	R (FONCE, E) FAODES E REILURE SWITHER ICALITE	OR M OR AILU WOU FLEC MOD ICH EVAL	IPS SHO IRE ILD TS E CIF UAT	ATVC ORTED. MODES ALWAYS THE RCUIT) FION OF

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:		EL REF NO.	NASA DATA BASELINE NEW											
SUBSYSTEM: MDAC ID: ITEM:	GNC 1310 CIRCUIT- ATVC'	S 1,2,3,4 P	OWER											
LEAD ANALYST:	ROBERT O'DONNE	LL												
ASSESSMENT:														
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM														
HDW/FU	INC A	В	С											
NASA [2 /1R IOA [3 /1R	[P] [P]	[F] [[P] [P] P]	[X] * []										
COMPARE [N /] []	[и][]	[N]										
RECOMMENDATIONS:	(If different	t from NASA)											
[/] []	[] [] (AI	[] DD/DELETE)										
* CIL RETENTION	RATIONALE: (If a	applicable)												
		I	ADEQUATE NADEQUATE											
REMARKS: IOA FAILURE MODE: POWER CIRCUIT FAILS OPEN (OFF) DURING POWER TRANSFER OR PREMATURELY. FMEA FAILURE MODE: ATVC POWER SW FAILS TO TRANSFER (OPEN) AFTER NASA/RI REEVALUATION OF FMEA AND FURTHER IOA EVALUATION OF SYSTEM OPERATION, IOA DOES CONCUR WITH THE NEW FMEA. WITH 2 ATVC PWR SWITCHES FAILED TO TRANSFER (OPEN). THERE WILL FYIST & 2 ON 2														
ATVC CHN FORCE F VEHICLE CONTROL. THE RESULTING LO OF ISOL VLV DRIV FOR EVALUATION O	TABLE, BUT													

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	GNC-1310D		NASA DATA: BASELINE NEW	r										
SUBSYSTEM: MDAC ID: ITEM:		3 1,2,3,4 PG	OWER											
LEAD ANALYST:	ROBERT O'DONNEL	L												
ASSESSMENT:														
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM HDW/FUNC A B C														
HDW/FU	NC A	В	C											
NASA [3 /1R IOA [3 /1R	[P] [P]	[F] [[P]	P] P]	[X] *										
COMPARE [/] []	[N] []	[N]										
RECOMMENDATIONS:	(If different	from NASA)											
[/] []	[] [[] DD/DELETE)										
* CIL RETENTION	RATIONALE: (If a		ADEQUATE NADEQUATE	[]										
REMARKS: IOA FAILURE MODE TRANSFER OR PREM FMEA FAILURE MOD SHORTED, PREMATU AFTER NASA/RI RE SYSTEM OPERATION WORST CASE, 1 CO FAIL OPEN (LOSS PWR SUPPLY WITHO READILY DETECTABL CHN IS DETECTABL CHN. LOSS OF IS	ATURELY. DE: ATVC POWER SWITCH OPERATION. EVALUATION OF FM I, IOA DOES CONCUMENTACT FAIL OPEN OF PWR SUPPLY/CHOUT CHN ISOLATION BLE, BUT THE RESU E. ISOL VLV DRI	FAILS OPEN POLE (CONT MEA AND FURT JR WITH THE (LOSS OF IN N), 3 CONT N), LOSS ON JUTING LOSS EVERS ARE RE	(OFF) DURI IACT) FAILS IHER IOA EVON NEW FMEA. SOL DRIVER) FAIL OPEN F CONTACTS OF RPC PWF EDUNDANTLY CTABLE. TH	ING POWER OPEN, VALUATION OF FOR PWR SW OPEN,										

ASSESSME ASSESSME NASA FME	/23/8 NC-1: 5-60-	37 31 -(:	0E 12)),	PRI	EL	RI	ΞF	NO.		NZ I	ASA BAS	DA' ELI N	TA NE EW	: [[x]						
SUBSYSTE MDAC ID:								3,4															
LEAD ANA	LY	ST	:		RO	BER!	r (ויכ	OON	INE	LL												
ASSESSMENT:																							
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM HDW/FUNC A B C																							
*****													[]	*							
COMPARE	[/	,]		[]		[]		[]			[]	
RECOMMEN	IDA'	TI:	ON	ıs:		(If	d:	if1	fer	ent	: 1	fro	m	NAS	A))							
	[/	•]		[]		[]		[]			[DD/			TE)
* CIL RE	TE	NT:	IO	N]	RAI	NOI	LI	€:	(I	fa	pp	oli	ca		•	AI JAI	EQU EQU	JATI JATI	e e	[]	
	INADEQUATE [] EMARKS: OA FAILURE MODE: POWER CIRCUIT FAILS OPEN (OFF) DURING POWER RANSFER OR PREMATURELY.																						
FMEA FAI NO DIFFE REDUNDAN REDUNDAN	FRANSFER OR PREMATURELY. FMEA FAILURE MODE: RPC FAILS OPEN TO ATVC PWR SUPPLY. FMEA FAILURE MODE: RPC FAILS OPEN TO ATVC PWR SUPPLY. FMEA FAILURE MODE: RPC FL ONE REDUNDANT RPC FL OPN IS DETECTABLE ON INSTRUMENTATION. TWO REDUNDANT RPC'S FL OPEN ARE DETECTABLE, AND RESULTS IN CONTROL CHANNEL ISOLATION.																						

ASSESSMENT DATE: 1/23/8 ASSESSMENT ID: GNC-13 NASA FMEA #: NONE SUBSYSTEM: GNC							•								SA DA' BASELI N	NE	[]	
SUBSYSTEMDAC ID:					GNC 1311 CIRCU	IT-	· A	TVC'S	3 1	L,2	2,3,	, 4	PC	WE	ER				
LEAD ANA	LYS	ST	:		ROBER	тС	ם'ס	ONNEI	L										
ASSESSMENT:																			
CRITICALITI ADDONDING DUMBERS													CIL	T					
		A			В				С				_						
NASA IOA	[3	/ /3]	[NA]	[N2] ¥]]	N2] A]		[]	*
COMPARE	[N	/N]	[N]	[N]		[N]		[]	
RECOMMEN	'DA'	TI	ons	:	(If	d:	Ĺff	eren	t :	fro	om 1	NAS	A))					
	[3	/3]	[NA	X]	(N	A]		[NZ	A]		[DD/DI		
* CIL RE	TE	NT	ION	F	RATION	AL	Ξ:	(If a	ap)	pl:	ical	ble	:) II	A A	DEQUAT DEQUAT	E E	[]	
ADEQUATE INADEQUATE REMARKS: IOA FAILURE MODE: POWER CIRCUIT FAILS CLOSED (ON), DITRANSFER OR PREMATURELY. FMEA FAILURE MODE: NA AFTER THE FMEA REVIEW, NASA/RI DID NOT COVER THIS FAIOA DOES RECOMMEND WRITING A NEW FMEA FOR COMPLETENE										FA]	LUR								

	05-1-FC	7252-00	01	Baselini Nev	A: ² [] V [X]
	GNC 1400 CIRCUIT	-BODY F	AP CNTL		
LEAD ANALYST:	ROBERT	o'donnei	LL		
ASSESSMENT:					
FLIGH	r		NCY SCRE	EENS	CIL ITEM
HDW/FU	NC	A	В	С	
NASA [3 /3 IOA [3 /1R] [NA] P]	[NA] [P]	[NA] [P]	[] *
COMPARE [/N] [N J	[N]	[N]	[]
RECOMMENDATIONS:	(If d	ifferent	from NA	.SA)	
[3 /1R] [Pj	[P]		[] DD/DELETE)
* CIL RETENTION I	RATIONAL	E: (If a	pplicabl		
DEMADUC.				ADEQUATE INADEQUATE	[]
REMARKS: IOA FAILURE MODE: LIMIT RESISTOR FA FMEA FAILURE MODE GROUND, INTERNAL THE BODY FLAP IS THE MANUAL UP/DOW MAINTAINED WITH E WITH BODY FLAP SW STATION OR SWITCH	AILS OPEN E: SWITCH SHORTS. CONTROLM IN TOGGLI BODY FLAM UTCH FA	N OR SHO H FAILS LED BY T E SWITCH P IN AUT LLED OPE	RTED TO (TO TRANS: HE AUTO/! ES. VEH: O OR MANI N. USE SI	GROUND. FER, OPEN, S MAN MODE (PB ICLE ATTITUD UAL MODE. WITCH IN OTH	HORTED TO I SW'S) AND E CAN BE

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/23/87 GNC-1401 05-1-FC7252-000	NASA DATA: BASELINE [] NEW [X]
SUBSYSTEM: MDAC ID: ITEM:	GNC 1401 CIRCUIT-BODY FL	AP CNTL
LEAD ANALYST:	ROBERT O'DONNEL	L
ASSESSMENT:		
CRITICAL: FLIGH	_	NCY SCREENS CIL ITEM
HDW/FU	NC A	в с
		[NA] [NA] [] * [P] [P]
COMPARE [/N] [и]	[и] [и] [
RECOMMENDATIONS:	(If different	: from NASA)
[3 /1R	[P]	[P] [P] [] (ADD/DELETE)
* CIL RETENTION	RATIONALE: (If a	applicable) ADEQUATE [] INADEQUATE []
GROUND, INTERNAL	DE: SWITCH FAILS SHORTS. CONTROLLED BY	TO TRANSFER, OPEN, SHORTED TO THE AUTO/MAN MODE (PBI SW'S) AND
THE MANUAL UP/DO MAINTAINED WITH WITH BODY FLAP S BE LOST IN BODY THE DOWN POSITION THE BODY FLAP UP	OWN TOGGLE SWITCH BODY FLAP IN AUT SWITCH FAILED IN FLAP MANUAL MODI ON, THE OTHER CRI	TO OR MANUAL MODE. UP POSITION, ATTITUDE CONTROL MAY E. IF BODY FLAP SWITCH FAILS IN EW POSITION CAN BE USED TO DRIVE ATTITUDE

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/23/87 GNC-1402 05-1-FC7253-000))1	NASA DATA BASELINE NEW	: [] [x]
MDAC ID:	GNC 1402 CIRCUIT-BODY FI	LAP CNTL		
LEAD ANALYST:	ROBERT O'DONNEI	LL		
ASSESSMENT:				
CRITICALI FLIGHT	TY REDUNDA	NCY SCREENS		CIL
	IC A	В	С	ITEM
NASA [3 /3 IOA [3 /1R] [NA]] [P]	[NA] [[P] [NA] P]	[] *
COMPARE [/N] [N]	[и]	n j	[]
RECOMMENDATIONS:	(If different	from NASA)		
[3 /1R] [P]	[1] [1]		[] D/DELETE)
* CIL RETENTION R	ATIONALE: (If a			
REMARKS:		INZ	ADEQUATE ADEQUATE	[]
IOA FAILURE MODE: CURRENT LIMIT RES FMEA FAILURE MODE OPERATION.	: SWITCH FAILS	N OR SHORTEI TO TRANSFER,	TO GROUNI OPEN, PRI	D. EMATURE
THE BODY FLAP IS (AND THE MANUAL UP) MAINTAINED WITH BO	ODY FLAP IN AUTO	LTCHES. VEH	HICLE ATTI	TUDE CAN BE
WITH BODY FLAP PB: IF BOTH PBIS FAIL COMMANDED POSITION	I SW FAILED OPEN OPEN. THE BODY	N, USE PBI I Flap Will b	N OTHER A	REW STATION. THE LAST

ASSESSMENT DATE ASSESSMENT ID: NASA FMEA #:	1/23/87 GNC-1403 05-1-FC7	GNC-1403 BASELINE [] 05-1-FC7253-0001 NEW [X]								
	1403	-BODY FLAP CNTL								
LEAD ANALYST:	ROBERT O	O'DONNELL								
ASSESSMENT:										
CRITICA FLIG	CIL ITEM									
	JNC	A B	С							
NASA [3 /3 IOA [3 /1] [R] [NA] [NA] [P]	NA] [] * P] []							
COMPARE [/N] [и] [и][и] []							
RECOMMENDATIONS	: (If di	ifferent from NASA)								
[3 /1	R] [P] [P] [P] [] (ADD/DELETE)							
* CIL RETENTION	RATIONALE	E: (If applicable) IN	ADEQUATE []							
CLOSED. FMEA FAILURE MOOPERATION. THE BODY FLAP I AND THE MANUAL MAINTAINED WITH THE SW CONTACT REDUNDANCY MANA AND REQUIRES THE FAILS ON (CONTACT WILL REMAIN IN	DE: SWITCH S CONTROLI UP/DOWN TO BODY FLAF FAILURES A GEMENT (RM E "AND" OF CTS SHORTE THE LAST OF	OGGLE SWITCHES. VE P IN AUTO OR MANUAL ARE HANDLED BY THE	R, OPEN, PREMATURE TUAL MODE (PBI SW'S) CHICLE ATTITUDE CAN BE MODE. STANDARD 3 CONTACT SW CS FIRST FAILED CONTACT AN OUTPUT. IF SW CONTROL CIRCUITS (AUTO OR MAN). THE							

ASSESS ASSESS NASA I	SME SME SME	NT NT A	D. I:	ATE: D:	1/23/ GNC-1 05-1-	1/23/87 N GNC-1403A 05-1-FC7253-0002										: [[:) x]	
SUBSYS MDAC I ITEM:	TE	M:			GNC 1403 CIRCU													
LEAD A	NA:	LY:	ST	:	ROBER'	r	0'1	DONNE	LL									
ASSESS	ME	NT	:															
	(CR:	IT: FI	CALI LIGHT	ITY F NC		RI A	EDUND	AN	CY B						CII		
	_																	
IC	A	[3	/3 /1R]	[NA P	A]	[NZ P	A]	[NZ P	A]		[]	*
COMPAR	E	[/N]	[N]	[N]	[N]		[]	
RECOMM	ENI	CAC	CIC	ons:	(If	d:	iff	feren	t:	fro	om NA	SA))					
		[3	/1R]	[P]	[P]	ι	P]		[DD/E		ETE)
* CIL	REI	CEN	T	ON F	RATIONA	LI	:	(If	apı	pli	cable	e)						
REMARK	s:											IN	AI IAI	DEQUA:	PE PE	[]	
IOA FA CLOSED	ILU •				BODY						PBI	SW	7I]	сн с	ONTA	CT	FAI	LS
FMEA FAILURE MODE: INTERNAL SHORTS. THE BODY FLAP IS CONTROLLED BY THE AUTO/MAN MODE (PBI STIME MANUAL UP/DOWN TOGGLE SWITCHES. VEHIICLE ATTITUDE MAINTAINED WITH BODY FLAP IN AUTO OR MANUAL MODE. WITH BODY FLAP PBI SW FAILED CLOSED, THE BODY FLAP CONTICUIT WILL REMAIN IN THE LAST COMMANDED POSITION (AUTORICUIT WILL REMAIN IN THE LAST COMMANDED AN INCREASE INFORKLOAD.											NTR	AN OL	BE					

ASSESSMENT DATE ASSESSMENT ID: NASA FMEA #:	GNC-14 05-1-1	3 / 104 FC7252-000	1	BASELI N	NE [] EW [X]
SUBSYSTEM: MDAC ID: ITEM:	1404	IT-BODY FL	AP CNTL		
LEAD ANALYST:	ROBER	r o'DONNEL	L	,	
ASSESSMENT:					
FLIC	HT	REDUNDA			CIL ITEM
HDW/I	TUNC	A	В	С	
NASA [3 /3 IOA [2 /3	I] LR]	[NA] [P]	[NA] [P]	[NA] [P]	[x] *
COMPARE [N /	1]	[N]	[N]	[N]	[N]
RECOMMENDATIONS	s: (If	different	from NA	SA)	
[3 /:	LR]	[P]	[P]	[P]	[] (ADD/DELETE)
* CIL RETENTION	N RATION	ALE: (If a	pplicabl	e) ADEQUAT INADEQUAT	re [] re []
REMARKS: IOA FAILURE MOI NASA FAILURE MOINTERNAL SHORTS	DDE: FAI	FLAP UP/D LS TO TRAN	OOWN CMD ISFER, OP	SWITCH JAM EN, SHORTE	MED. D TO GROUND,
THE BODY FLAP : THE MANUAL UP/I MAINTAINED WITH	S CONTRO	GLE SWITCH	IES. VEH	ICLE ATTIT	PBI SW'S) AND UDE CAN BE
	SWITCH OF FLAP MOON, THE OF BUT I	JAMMED IN ANUAL MODE OTHER CREW MAY LOSE A	UP POSIT WITH J POSITIO ATTITUDE	TION, ATTII BODY FLAP	TUDE CONTROL MAY SWITCH JAMMED JSED TO DRIVE

ASSESS ASSESS NASA F	/16/8 NC-15 5-1-1	37 50: FC	1 72!	57-00	001						ASA DA BASELI 1	INE)					
SUBSYS MDAC I ITEM:	ΑP	PI	BI'S	(F)	WD	&	AFT)											
LEAD A	NALY	ST	:	к.	PII	ET	Z			,									
ASSESS	MENT	:																	
		F	ICAL LIGH W/FU	T			RI A	EDUNI	AN	CY B	sc	REE	NS	c C			CII		
NAS.	A [3	/3 /2R]		[NA P	A]	[NZ P	A.]		[[NA P]		[]	*
COMPAR	E [/N]		[N]	[N)		[N]		E]	
RECOMM	ENDA	TI	ons:		(If	đi	lfi	eren	it i	fro	om	NAS	A)						
	[3	/2R]		[P]	[P]		[P]	(AE	[D/D		TE)
* CIL		NT	ION :	RAI	YION?	LI	E:	(If	app	,1 :	ica				EQUAT		[]	
IOA FA FMEA F PREMAT IOA BE	ILUR AILU URE LIEV	RE OP: ES	MOD: ERAT: THA	E: ION	FAI	LS	r	O TR	ANS	SFI	ER,	OPI	EN	Ι,	INTER				-
LOSS O	r Mi	5 5.	TON.																

ASSESSMEI ASSESSMEI NASA FME	NΤ	TE) •	GNO	C = 1.5	02	25	7-00	01					_	SA DAT SASELIN NE	E	[x			
SUBSYSTEM MDAC ID:	M:			GN: 15: A/:	02	.P	PB	ai's	(FV	۷D	&	AFT)							
LEAD ANA	LYS	ST:	:	ĸ.	PIE	T2	3													
ASSESSME	NT:	:																		
		FI	[CAL]					DUND	AN		s	CREE	NS				CII	-		
			/FUI				A			В				С						
NASA IOA	[3 3	/3 /2R]		[NA P]	[N. P	A]		[NA P	A]		[]	*	•
COMPARE	[/N]		[N	1	[N]		[N]		[]		
RECOMMEN	DA!	ri	ons:		(If	đ:	if	feren	t	fr	om	NAS	A)						
	[3	/2R]		[P	1	(P]		[P]	(Al	[\dc			Œ)
* CIL RE	TE:	NT:	ION 1	RAI	'ION	ΑL	E:	(If	ap	pl	ic	able		A NA	DEQUATI DEQUATI	E E	[]		
REMARKS: IOA FAII FMEA FAI PREMATUR	UR	RE	MOD	E:	FA.	rc:	H (CONTA TO TE	ACT RAN	F	AI ER	LED , OI	0	PE	N.				ξT,	,
IOA BELI	EV	ES	THA	T I	oss	0	F Z	ABIL1	[TY	T	0	CHAN	IG:	E !	MODES	CO	ULD	CA	US	SE.

ASSESSMI ASSESSMI NASA FMI	ייותי	ID:	GNC-1	GNC-1510 BASELINE														
SUBSYSTE MDAC ID:			GNC 1510 FWD A															
LEAD ANA	LYSI	C:	K. PI	ET2	2													
ASSESSME	ENT:																	,
	F	'LIGH'					DAN		SCR	REE	NS				CII			
			NC		A			В				С						
NASA IOA	[3	/3 /1R]]	NA P	A]	[NZ P	A]			NA P	A]		[[]	*	
COMPARE	[/N]	[N)	[N]		[N]		[]		
RECOMMEN	DATI	ONS:	(If	di	f1	ere	nt :	fro	om N.	IAS	A)							
	[3	/2R]	[P]	[P]		[P]	(Al	[DD/E		ETE)	
* CIL RE	TENT	ION I	RATION	ALE	:	(If	app) 1	cab	le		3.5			_	_		
REMARKS:													EQUA EQUA		[]		
FMEA FAI	OA FAILURE MODE: SWITCH CONTACT FAILED CLOSED. MEA FAILURE MODE: FAILS TO TRANSFER OUT OF AUTO MODE, FAILS TO																	

DEPRESS, OPEN, INTERNAL SHORTS, PREMATURE OPERATION.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	3/16/87 GNC-1513 05-1-FC3	1 7258-0001		NASA DATA: BASELINE NEW	
MDAC ID:	GNC 1511 FWD AUTO	O/MAN PBI'	s		
LEAD ANALYST:	K. PIET	z			
ASSESSMENT:					
CRITICAL FLIGH		REDUNDANC	Y SCREENS	3	CIL ITEM
	NC	A	В	С	
NASA [3 /3 IOA [3 /2R] [NA] []	NA] [P] [NA] P]	[] *
COMPARE [/N] [и] [N] [и ј	[]
RECOMMENDATIONS:	(If d	ifferent f	rom NASA)	ı	
[3 /2R) · [P] [P] [P] (AI	[] DD/DELETE)
* CIL RETENTION	RATIONAL	E: (If app	licable) Iñ	ADEQUATE IADEQUATE	[]
REMARKS: IOA FAILURE MODE FMEA FAILURE MOD DEPRESS, OPEN, I	E: FAIL	S TO TRANS	FAILED OF	PEN. OF AUTO MOI	
IOA BELIEVES THA LOSS OF MISSION.	T LOSS O	F ABILITY	TO CHANGI	MODES COL	JLD RESULT IN

ASSESSMENT DATA ASSESSMENT ID: NASA FMEA #:	GNC-15 05-1-1	37 515 FC7258-00	NASA DATA BASELINE NEW	~~						
SUBSYSTEM: MDAC ID: ITEM:	1515	JTO/MAN P	BI'S							
LEAD ANALYST:	K. PII	ETZ								
ASSESSMENT:										
CRITICALITY REDUNDANCY SCREENS CIL ITEM										
HDW/	FUNC	A	В	С						
NASA [3 / IOA [3 /	3] 2R]	[NA] [P]	[NA] [P]	[NA] [P]	[] *					
COMPARE [/	n j	[N]	[N]	[N]	[]					
RECOMMENDATION	S: (If	differen	t from NAS	SA)						
[3 /	2R]	[P]	[P]		[] DD/DELETE)					
* CIL RETENTIO	N RATIONA	LE: (If	applicable	e)						
		, , , , , , , , , , , , , , , , , , , 		ADEQUATE INADEQUATE	[]					
REMARKS: IOA FAILURE MO FMEA FAILURE M DEPRESS, OPEN	ODE: FAI	LS TO TR	ANSFER OUT	OF AUTO MOI	DE, FAILS TO					
		CHURTO,	TURENTURE	OPPINATION.						

IOA BELIEVES THAT LOSS OF ABILITY TO CHANGE MODES COULD RESULT IN

LOSS OF MISSION.

ASSESSMEN ASSESSMEN NASA FMEA			NC-1516 BASELIN 5-1-FC7258-0001 NE								
SUBSYSTEM MDAC ID: ITEM:		GNC 1516 AFT A	UTO,	/MAN	PBI'	S					
LEAD ANAL	YST:	K. PI	ETZ			,					
ASSESSMEN	T:										
C	RITICA FLIC	LITY	1	REDUN	DANC	CY SCR	EENS	3	CII		
		FUNC	1	A		В		С			
NASA IOA	[3 /3	3] 2R]	[]	NA] P]]	NA] P]	[NA] P]	[] *	
COMPARE	[/1	1]	[]	1 1	[N]	[и]	[] .	
RECOMMEND	NOITA	5: (I1	di	ffere	nt i	from N	ASA))			
	[3 /:	2R]	[P]	[P]	[P]	[(ADD/I] DELETE)	
* CIL RET	TENTIOI	N RATION	IALE	: (If	app	plicab		ADEQUA NADEQUA	TE []	
REMARKS: IOA FAILU FMEA FAIL DEPRESS, IOA BELLI LOSS OF M	LURE MO OPEN, EVES T	ODE: FA INTERNA HAT LOSS	AILS AL S	TO I HORTS	RANS	SFER O REMATU	UT (RE (OF AUTO OPERATI	ON.		

								ASA DATA BASELINI NEV										
SUBSYSTE MDAC ID:																		
LEAD ANA	LY	ST	:	K. PI	ET:	Z												
ASSESSME	ENT	:																
	CR:		ICAL:	ITY F		RI	EDUNI	DAN	CY	so	CREE	NS	5		CI	LEM		
	1	HD	W/FUI	NC		A			В				С					
NASA IOA	[3 3	/3 /2R]	[NA P	\]	[N. P	A]]	NZ P	A]	[]		*
COMPARE	[/N]	[N]	[N]		[N]	[)		
RECOMMEN	DA:	ric	ons:	(If	d:	lff	eren	it.	fr	om	NAS	A)						
	[3	/2R]	[P]	[P]		[P		[.DD/:			ΓE)
* CIL RE	TEN	√T]	ON F	RATIONA	L	E :	(If	ap	91	ica	ble)						
REMARKS:												IN	Άľ	EQUATE EQUATE	[]		
IOA FAIL FMEA FAI TO DEPRE IOA BELI	LUF SS,	RE , c	MODE , PEN	: FAI INTER	LS	L	O TR	ANS	SFI PI	ER REM	OUT ATUI	ORE	F	VENIER	N.			
TOCC OF	MTC														السال	CA	0.0	ندر

LOSS OF MISSION.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	: [] [A]			
SUBSYSTEM: MDAC ID: ITEM:	GNC 1521 NORM/VE	RN PBI'S (FWD	& AFT)	
LEAD ANALYST:	K. PIET	Z		
ASSESSMENT:				•
CRITICAL FLIGH		REDUNDANCY SO	CREENS	CIL ITEM
	NC	A B	С	
NASA [3 /3 IOA [3 /2R] [NA] [NA] P] [P]	[NA] [P]	[] *
COMPARE [/N] [и] [и]	[N]	[]
RECOMMENDATIONS:	(If d	ifferent from	NASA)	
[3 /2R	:] [P] [P]	[P]	[] DD/DELETE)
* CIL RETENTION	RATIONAL	E: (If applica	able) ADEQUATE INADEQUATE	[]
REMARKS: IOA FAILURE MODE FMEA FAILURE MODE TO DEPRESS, OPEN IOA BELIEVES THA	DE: FAIL , INTERN T LOSS O	S TO TRANSFER AL SHORT, PREI	LED OPEN. OUT OF VERNIER MATURE OPERATION	MODE, FAILS

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:		NASA DATA BASELINE NEW								
MDAC ID:	GNC 1530 FWD DIS	C RATE RO	T PBI'S							
LEAD ANALYST:	K. PIET	Z								
ASSESSMENT:				· ·						
CRITICAL: FLIGHT		REDUNDAN	CY SCREEN	rs	CIL ITEM					
HDW/FU	4C	A	В	С	112					
NASA [3 /3 IOA [3 /2R] [NA] [P] [NA] [P] [NA] P]	* []					
COMPARE [/N] [n] [N] [N]	[]					
RECOMMENDATIONS:	(If d	ifferent	from NASA	.)						
[3 /2R] [P] [P] [[] DD/DELETE)					
* CIL RETENTION F	RATIONALI	E: (If ap	plicable)							
			I	ADEQUATE NADEQUATE	[]					
FMEA FAILURE MODE	CEMARKS: COA FAILURE MODE: SWITCH CONTACT FAILED CLOSED. THEA FAILURE MODE: FAILS TO TRANSFER, OPEN, INTERNAL SHORT, PREMATURE OPERATION.									
IOA BELIEVES THAT LOSS OF MISSION.	LOSS OF	ABILITY	TO CHANG	E MODES CO	ULD RESULT I					

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	GNC-1531									
SUBSYSTEM: MDAC ID: ITEM:	GNC 1531 FWD DISC RAT	E ROT PBI'S								
LEAD ANALYST:	K. PIETZ									
ASSESSMENT:										
CRITICAL FLIGH	ITY REDU	NDANCY SCREEN	· 	CIL TEM						
HDW/FU		В	С							
NASA [3 /3 IOA [3 /2R] [NA]	[NA] [[P] [NA] [P] [] *						
COMPARE [/N] [n]	ן נאן	[и]	. 1						
RECOMMENDATIONS:	(If differ	ent from NASA	7)							
[3 /2R	[P]	[P] [[P] [ADI] D/DELETE)						
* CIL RETENTION	RATIONALE: (I									
REMARKS: IOA FAILURE MODE: SWITCH CONTACT FAILED OPEN. FMEA FAILURE MODE: FAILS TO TRANSFER, OPEN, INTERNAL SHORT, PREMATURE OPERATION. IOA BELIEVES THAT LOSS OF ABILITY TO CHANGE MODES COULD RESULT IN										
LOSS OF MISSION.		LITY TO CHANG	JE MODES COUI	DO KESOTI IN						

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	3/16/87 GNC-153 05-1-FC	L	NASA DATA: BASELINE [] NEW [X]						
MDAC ID:	GNC 1535 FWD PUL	SE ROT PE	sı's						
LEAD ANALYST:	K. PIET	Z							
ASSESSMENT:									
FLIGH	T	REDUNDAN	CY SCREE	ens	CIL ITEM				
HDW/FU	NC	A	В	С					
NASA [3 /3 IOA [3 /2R] [NA] [P] [NA] P]	[NA] [P]	[] *				
COMPARE [/N	j [и ј [N]	[א]	[]				
RECOMMENDATIONS:	(If d	ifferent	from NAS	SA)					
[3 /2R] [P] [P]		[] DD/DELETE)				
* CIL RETENTION	RATIONAL	E: (If ap	plicable						
REMARKS:				ADEQUATE INADEQUATE	[]				
IOA FAILURE MODE FMEA FAILURE MODI PREMATURE OPERAT	E: FAILS	H CONTACT S TO TRAN	FAILED SFER, OP	CLOSED. EN, INTERNA	L SHORT,				
IOA BELIEVES THAT LOSS OF MISSION.	LOSS O	F ABILITY	TO CHAN	GE MODES CO	ULD RESULT IN				

ASSESSME ASSESSME NASA FME	NT DANT I	ATE: D:	3/1 GNC 05-	NC-1536 BASELI								[]				
SUBSYSTE MDAC ID: ITEM:			GNC 153 FWD		SE	ROT	PBI	:¹s	;								
LEAD ANA	LYST	:	ĸ.	PIET:	Z												
ASSESSME	ENT:		1														
	F	ICAL LIGH W/FU	T		RI A		DANG	EY B	sc	REEN	s c			CIL			
NASA IOA	[3	/3 /2R]]	NZ P	A]]	N# P	A]	[N F	[A]		[]	*	
COMPARE	ι	/N	1	[N]	[N]	[N	[]		[]		
RECOMMEN	NDATI	ons:	(If d	if	fere	ent :	fro	o m	NASA	(۱						
	[3	/2R	.]	[P]	[P	3	[E)	(Al	[DD/E		ETE)	
* CIL RI	ETENT	!ION	RATI	ONAL	E:	(II	f ap	p1 :	ica		- 2	ADEQU ADEQU	JATE JATE	[]		
REMARKS: IOA FAIL FMEA FAIL PREMATUL IOA BELI LOSS OF	LURE ILURE RE OI IEVES	MOE PERAT THA	E: LON. T LO	FAII	S	TO ?	[RAN	SF	ER,	ED (PP EN,	EN. , INT	TERNA:	L SH	iori		' IN

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	3/16/87 GNC-154 05-1-FC	3/16/87 NASA DATA GNC-1540 BASELINA D5-1-FC7261-0001 NEW							
SUBSYSTEM: MDAC ID: ITEM:	GNC 1540 AFT DIS	C RATE	ROT PBI'S						
LEAD ANALYST:	K. PIET	Z							
ASSESSMENT:									
CRITICAL FLIGH		REDUNDA	ANCY SCREEN	rs .	CIL ITEM				
HDW/FU	-	A	В	C	11EM				
NASA [3 /3 IOA [3 /2R] [NA] P]	[NA] [[P] [NA] P]	[] *				
COMPARE [/N] [n j	[N]	N]	[]				
RECOMMENDATIONS:	(If di	ifferent	from NASA)					
[3 /2R) [P]	[P] [•	[DD/DELETE)				
* CIL RETENTION I	RATIONALE	E: (If a	pplicable)						
DEWS DVC.			I	ADEQUATE NADEQUATE	[]				
FMEA FAILURE MODE	OA FAILURE MODE: SWITCH CONTACT FAILE CLOSED. MEA FAILURE MODE: FAILS TO TRANSFER, OPEN, INTERNAL SHORT, REMATURE OPERATION.								
	OA BELIEVES THAT LOSS OF ABILITY TO CHANGE MODES COULD RESULT IN								

ASSESSMENT ASSESSMENT NASA FMEA #	DATE: ID: :	GNC-15	7 41 C7	261	L-0001		NASA DATA: BASELINE NEW	[
SUBSYSTEM: MDAC ID: ITEM:		GNC 1541 AFT DI	sc	R.	ATE RO	r	PBI'S						
LEAD ANALYS	T:	K. PIE	TZ										
ASSESSMENT:													
CRI	CIL												
	FLIGHT DW/FU		В		С								
NASA [IOA [3 /3 3 /2R]]	NA P] [Ì	NA] P]	[NA] P]	[] *		
COMPARE [/N	3	[N) [1	и]	[n]	[]		
RECOMMENDAT	cions:	(If	di	lff	erent	f	rom NAS	A))				
[3 /2R]	[P] []	P]	[P] (AI	[DD/D] ELETE)		
* CIL RETEN	TION :	RATIONA	LE	E:	(If ap	g.	licable		ADEQUATE NADEQUATE	[]		
FMEA FAILUI	REMARKS: IOA FAILURE MODE: SWITCH CONTACT FAILED OPEN. FMEA FAILURE MODE: FAILS TO TRANSFER, OPEN, INTERNAL SHORT, PREMATURE OPERATION. IOA BELIEVES THAT LOSS OF ABILITY TO CHANGE MODES COULD RESULT IN												
TOSS OF MIS)OTO14 •												

ASSESSMENT DATE: 3/16/8 ASSESSMENT ID: GNC-1: NASA FMEA #: 05-1-1								NC-1545 BASELINE										E [
SUBSYST: MDAC ID ITEM:	EM:			:	GNC 1545 AFT		SE	RO?	r p	B	I':	5							-		
LEAD AN	LEAD ANALYST: K. PIET																				
ASSESSMI	ENT	:																			
		F	LIG	ΙT	ry C		R	EDUI	NDA	N	CY	sc	REI	ens	3			CI	L		
		A				В				C				1311							
NASA IOA	[3	/3 /21] [{]	N. P	A]]	N? P]		[NZ P	A]		[]	*	
COMPARE	[/N	J		[N]		[N]		[N]		[]		
RECOMMEN	IDA'	TI:	ONS:		(I1	f d:	if	fere	nt	f	fro	m	Nas	A)							
	[3	/2F	2]		[P]		(P]		[P]	(Al) DELE	ETE)	
* CIL RE	TE	NT:	ION	RA	TION	IALI	: 2	(If	a	ge	li	cal	ble								
REMARKS:																EQUA EQUA]		
IOA FAIL FMEA FAI PREMATAU	URI LUI RE	RE OI	MOD ERA	E: TI	FA ON.	ILS	ı	O T	RAN	IS	FE	R,	OP	EN	,	INTE					
IOA BELI LOSS OF	EVI	ES	THA	T	LOSS	OF	A	BIL	ITY	?	то	CI	HAN	GE	M	ODES	COL	JLD	RES	ULT	IN

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	3/16/87 GNC-1546 05-1-FC7261-00	01	NASA DATA: BASELINE NEW										
SUBSYSTEM: MDAC ID: ITEM:	GNC 1546 AFT PULSE ROT	PBI'S											
LEAD ANALYST:	K. PIETZ												
ASSESSMENT:													
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM HDW/FUNC A B C													
NASA [3 /3 IOA [3 /2R] [NA]] [P]	[NA] [[P] [NA] P]	[] *									
COMPARE [/N] [N]	[N] [и]	[]									
RECOMMENDATIONS:	(If differer	nt from NASA)										
[3 /2R] [P]	[P] [P] (AI	[] DD/DELETE)									
* CIL RETENTION	RATIONALE: (If		ADEQUATE NADEQUATE	[]									
FMEA FAILURE MOD	INADEQUATE [] EMARKS: OA FAILURE MODE: SWITCH CONTACT FAILED OPEN. MEA FAILURE MODE: FAILS TO TRANSFER, OPEN, INTERNAL SHORT, PREMATURE OPERATION. OA BELIEVES THAT LOSS OF ABILITY TO CHANGE MODES COULD RESULT IN												

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:		-0001	BASELINE	NASA DATA: BASELINE [] NEW [X]										
SUBSYSTEM: MDAC ID: ITEM:	GNC 1550 ACCEL ROT P	BI'S (FWD & .	AFT)											
LEAD ANALYST:	K. PIETZ													
CRITICALITY REDUNDANCY SCREENS														
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM HDW/FUNC A B C														
FLIGHT ITEM HDW/FUNC A B C														
NASA [3 /3 IOA [3 /2R] [NA]] [P]	[NA] [P]	[NA] [P]	[] *										
COMPARE [/N] [N]	[и]	[N]	[]										
RECOMMENDATIONS:	(If diffe	rent from NAS	SA)											
[3 /2R] [P]	[P]	[P] (A	[DD/DELETE)										
* CIL RETENTION F	RATIONALE: (If applicable	•											
			ADEQUATE INADEQUATE											
REMARKS: IOA FAILURE MODE: FMEA FAILURE MODE PREMATURE OPERATI	: FAILS TO	TRANSFER, OF	PEN, INTERNA	•										
IOA BELIEVES THAT	LOSS OF ABI	LITY TO CHAN	IGE MODES CO	ULD RESULT IN										

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	GNC-1551	261-0001	NASA DATA: BASELINE NEW	[x]									
SUBSYSTEM: MDAC ID: ITEM:	יי												
LEAD ANALYST:	K. PIETZ	i											
ASSESSMENT:													
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM HDW/FUNC A B C													
HDW/FU	11011												
NASA [3 /3 IOA [3 /2R] [NA] [:	NA] [P] [NA] P]	[] *								
COMPARE [/N] [и] [и] [и]	[]								
RECOMMENDATIONS:	(If di	fferent f	rom NASA)										
[3 /2R] [P] [P] [P] (AI	[] DD/DELETE)								
* CIL RETENTION	RATIONALE	E: (If app		ADEQUATE NADEQUATE	[]								
REMARKS: IOA FAILURE MODE FMEA FAILURE MODE PREMATURE OPERAT	E: FAILS	TO TRANS	FER, OPEN	, INTERNAI									
IOA BELIEVES THAT LOSS OF MISSION.	LD RESULT IN												

ASSESSMENT DATE: 3/16/8 ASSESSMENT ID: GNC-15 NASA FMEA #: 05-1-F															NASA DATA: BASELINE [] NEW [X]						
SUBSYSTEM: GNC MDAC ID: 1560 ITEM: TRANSLA						LA!	ATION PBI'S (FWD & AFT)														
LEAD ANALYST: K. PIE							Z														
ASSESSMENT:																					
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM																					
							A				В				С			111	7M		
NASA IOA	[[3 3	/3 /2R]		[NZ P	A]		[NA P	A]		[NA P	\]]		[]	*	
COMPARE	[/N]		[N]		[N]	1	[N]		[]		
RECOMMEN	DA'	ri	ons:	(Ιf	đ:	if	fer	ent	: 1	fro	om N	as?	A)							
	[3	/2R]		[P]		[P]	1	[P]	(Al	[DD/I] DEL	ETE	
* CIL RE	TE	NT:	ION 1	RATI	ONA	LI	€:	(1	f a	ıpp	1 1	cab	·			EQUAT		[]		
REMARKS: IOA FAILURE MODE: SWITCH FMEA FAILURE MODE: FAILURE MODE: FAILURE MODE: FAILURE MODE: FAILURE OPERATION. IOA BELIEVES THAT LOSS OF THE PROPERTY OF T								O	TRA	MS	FF	ER,	D (OPI	CL EN	os ,	ED.	ena]	LSI	ior	-	
LOSS OF	LOSS OF MISSION.																				

ASSESSMENT DATE: 3/16/87 ASSESSMENT ID: GNC-1561 NASA FMEA #: 05-1-FC7260-000										-	BASELIN NE			
SUBSYSTEM: MDAC ID: ITEM:			LAT	ric	ON PB	I'S	5	(FWD	& <i>1</i>	AF T	r)			
LEAD ANALYST	r:	K. PI	ET2	Z										
ASSESSMENT:														
F	LIGH	_				AN			EENS			CI	L EM	
Н	W/FUI	NC		A			В			С				
NASA [3	3 /3 3 /2R]	[NA P	A]	[N. P	A]	[NA P	A]]	[]	*
COMPARE [/N]	(N)	[N]	נ	N]	[)	
RECOMMENDATI	cons:	(If	đ:	ifi	feren	t:	fr	om N	ASA)				
[3	3 /2R	1	[P	3	[P]	[P] (.		DEL:	ETE)
* CIL RETENT	rion 1	RATION	'ALI	Ε:	(If	apj	pl	icab	le) I	A IAN	DEQUATE DEQUATE	[]	
REMARKS: IOA FAILURE FMEA FAILURE PREMATURE OF TRANSFER INT	E MOD: PERAT:	E: FA ION; F	IL	5 :	ro Tr	AN	SF	ER,	OPE	N,	INTERN	AL S	HOR'	Γ,
IOA BELIEVES LOSS OF MISS AS 3/2R.	S THA	T LOSS	01 R	F ATI	ABILI ES ON	TY	T	O CH FAIL	ang: S T	E 1	MODES C TRANSFE	OULI R IN	RE:	SULT IN LOW Z

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	3/16/87 GNC-156 05-1-(T	3/16/87 NASA DATA GNC-1561B BASELINE 05-1-(TBD06) NEW											
SUBSYSTEM: MDAC ID: ITEM:	GNC 1561	L561 TRANSLATION PBI'S (FWD & AFT)											
LEAD ANALYST:	K. PIET	z											
ASSESSMENT:													
CRITICALITY REDUNDANCY SCREENS CIL FLIGHT ITEM													
HDW/FUI	4C	A	В	С									
NASA [3 /3 IOA [3 /2R] [NA] [P] [NA] [P] [NA] P]	[] *								
COMPARE [/N] [и ј [и ј [N]	[]								
RECOMMENDATIONS:	(If d	ifferent	from NASA)	1									
[3 /2R] [P] [P] [[] DD/DELETE)								
* CIL RETENTION I	RATIONALI	E: (If ap	plicable)										
		,	-	ADEQUATE IADEQUATE	[]								
REMARKS: IOA FAILURE MODE: FMEA FAILURE MODE LVLH MODE, OPEN.	E: SW MA	N WODE L	FAILED OF VLH: FAII	PEN. S TO TRANS	FER TO THE								
IOA BELIEVES THAT LOSS OF MISSION. AS 3/2R.	C LOSS OF	F ABILITY ATES ONLY	TO CHANGE	MODES COU TRANSFER	ILD RESULT IN INTO LOW Z								

	1		NASA DATA:										
ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	[x]												
SUBSYSTEM: MDAC ID: ITEM:	GNC 1561 TRANSLATI	ION PBI'S (FWD & 2	AFT)										
LEAD ANALYST:	K. PIETZ												
ASSESSMENT:													
CRITICALITY REDUNDANCY SCREENS CIL ITEM													
HDW/FU		A B	C										
NASA [3 /2R IOA [3 /2R] []	P] [P] [P] [P] [P] P]	[] *									
COMPARE [/] [] [] [1	[]									
RECOMMENDATIONS:	(If di	fferent from NASA	.)										
[/] [] [] [] (A)	[] DD/DELETE)									
* CIL RETENTION	RATIONALE	: (If applicable)	ADEQUATE	[]									
FMEA FAILURE MOI	DE: SW MA DW Z, OPEN AT LOSS OF	H CONTACT FAILED (AN MODE LOW Z TRAM N, INTERNAL SHORTS F ABILITY TO CHANG ATES ONLY "FAILS O	SLATION: S. E MODES CO	ULD RESULT IN									

AS 3/2R.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	3/16/87 GNC-157 05-1-FC	, '0 :7257-00	01	NASA DATA: BASELINE [] NEW [X]					
SUBSYSTEM: MDAC ID: ITEM:	GNC 1570 A/B PBI	'S (FWD	& AFT)						
LEAD ANALYST:	K. PIET	Z							
ASSESSMENT:									
CRITICAL: FLIGHT	ŗ	REDUNDA	NCY SCRE	ENS	CIL ITEM				
HDW/FU		A	В	С					
NASA [3 /3 IOA [3 /2R] [NA] P]	[NA] [P]	[NA] [P]	[] *				
COMPARE [/N] [ן א	[N]	[N]	[]				
RECOMMENDATIONS:	(If d	ifferent	from NA	SA)					
[3 /2R] [P]	[P]		[] DD/DELETE;				
* CIL RETENTION R	ATIONALE	: (If a	pplicable	≘)					
REMARKS:				ADEQUATE INADEQUATE	[]				
IOA FAILURE MODE: FMEA FAILURE MODE PREMATURE OPERATI	: FAILS ON.	TO TRA	NFER, OPI	EN, INTERNAL					
IOA BELIEVES THAT LOSS OF MISSION.	LOSS OF	ABILIT	Y TO CHAN	IGE MODES COU	LD CAUSE				

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	GNC-1575										
MDAC ID:	GNC 1575 FWD AUTO PB	ı									
LEAD ANALYST:	K. PIETZ										
ASSESSMENT:											
CRITICAL! FLIGHT		UNDANCY SCREEN	រន	CIL ITEM							
HDW/FU		В	С								
NASA [3 /3 IOA [2 /2] [NA]] [P]	[NA] [P]	[NA] [P]	[] * [x]							
COMPARE [N /N] [N]	[11]	[N]	[и]							
RECOMMENDATIONS:	(If diffe	erent from NASA	A)								
[3 /2R] [P]	[P]	[P] (Al	[] DD/DELETE)							
* CIL RETENTION	RATIONALE: ((If applicable)) ADEQUATE INADEQUATE	[]							
REMARKS: IOA FAILURE MODE FMEA FAILURE MODE DEPRESS, OPEN, P	E: FAILS TO	IN DEPRESSED TRANSFER OUT	POSITION.								

ASSESSMI ASSESSMI NASA FMI	TNE	ID:	GNC	6/87 -157 1-(T	6)1)						ASA DA BASELI N		[к]	
SUBSYSTE MDAC ID:			GNC 157 FWD	6 Man	PE	BI										
LEAD ANALYST: K. PIETZ																
ASSESSME	ENT:															
		TICAL FLIGH	T		RE	נטם	NDAI	ICY	SCR	EENS	3			CII		
	H	DW/FU	NC		A			E	3		С					
NASA IOA	[2 /2 2 /2]	ĵ [NA P]	[N	[A]		NA P			K]	[]	*
COMPARE	[/]	[N]	[N]	ſ	N]		[)	
RECOMMEN	DAT	ions:	(1	If d:	iff	ere	ent	fr	om N	ASA)						
	[/]	[]	(]	Ĺ]	(AD	[D/D	ELI	ETE)
* CIL RE	TEN'	TION 1	RATIC	NALI	ጀ:	(If	f ap	pl	icab	le)						
REMARKS:										IN		EQUAT!		[X]	
IOA FAIL FMEA FAI	URE LURI	MODE E MOD										ITION MANUA		ODE		

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:		NC-1577 BASELINE 5-1-FC7258-0001 NEW							
SUBSYSTEM:	GNC 1577	O/MAN PBI							
LEAD ANALYST:	K. PIET	Z							
ASSESSMENT:									
CRITICAL		REDUNDAN	CY SCREE	NS	CIL ITEM				
FLIGHT HDW/FU		A	В	С	IIEM				
NASA [3 /3 IOA [2 /2] [NA] [P] [NA] P]	[NA] [P]	[] * [x]				
COMPARE [N /N] [и] [и ј	[и]	[N]				
RECOMMENDATIONS:	(If d	ifferent	from NAS	A)					
[3 /2R] [P] [P]	[P] (A)	[] DD/DELETE)				
* CIL RETENTION	RATIONALI	E: (If ap	_) ADEQUATE INADEQUATE					
REMARKS: TOA FAILURE MODE	: PBI S	TUCK IN D	EPRESSED	POSITION.					

FMEA FAILURE MODES: FAILS TO TRANSFER OUT OF AUTO MODE, FAILS TO DEPRESSION, INTERNAL SHORTS, PREMAUTRE OPERATION, FAILS TO TRANSFER OUT OF MAN.

ASSESSME ASSESSME NASA FME	NT	ID:	GNC-	/17/87 NASA DATA: NC-1580 BASELINE [] 5-1-(TB002) NEW [X]							
SUBSYSTE MDAC ID:			GNC 1580 NORM		N PBI	'S (F	WD &	AFT	')		
LEAD ANA	LYS'	T:	K. P	IETZ							
ASSESSME	NT:										
		TICAL FLIGH	ITY T	;	REDUN	DANCY	SCR	EENS		CIL ITEM	
	H	DW/FU	NC	7	A	В			С		
NASA IOA	[:	2 /2 2 /2]	[]	NA] P]	[N [P	A]		NA] P]	[X] * [X]	
COMPARE	[/]	[]	и ј	[N]	[и]	[]	
RECOMMEN	DAT:	ions:	(I	f di	ffere	nt fr	om N	ASA)			
	[/]	[]	[]	(]	[] (ADD/DELETE)	
* CIL RE	TEN:	rion	RATIO	NALE	: (If	appl	icab	•			
DEMA DEG.									ADEQUAT ADEQUAT		
REMARKS: IOA FAIL FMEA FAI NOT EXAC COULD CA	LURI T M	E MOD ATCH:	E: F. IOA	AILS BEL	TO TI	RANSF	ER O	JT O	F NORMA		

ASSESSMEN ASSESSMEN NASA FME	NT NT A	D/ I! #:	ATE: D:	3/ GN 05	17/8 IC-15 5-1-I	37 58: FC:	1 726	51-	-00	01					_	SASEL		[
SUBSYSTEMDAC ID:				15		JL	SE	&	D I	RA!	ΓE	R	OT E	B	['5	3					
LEAD ANA	LY	ST	:	K.	PII	ET:	Z														
ASSESSME	NT	:																			
		F	LIGH	T	ľ			EDŪ	JND	AN		S	CREE	ENS					CL CEN		
	1	HDI	W/FC	INC			A				В				С						
NASA IOA	[3 2	/3 /2]		[N? P	\]		[NA P	A]		[NA P]		[x]	*
COMPARE	[N	/N]		[N]		[N]		[N]		[N]	
RECOMMEN	DA'	rI(ons:		(If	d :	ifi	fei	ren	t :	fro	om	NAS	A))						
	[3	/2F	2]		[P]		[P)		[P]	(AI			ELI	ETE)
* CIL RE	TE	NT:	ION	RAT	CION	AL	E:	(:	[f	ap]	pl:	ic	able	-		DEQUA'		[]	
REMARKS: IOA FAIL FMEA FAI PREMATUR IOA BELI	LUI E (EV)	RE OP: ES	MOI ERAI THA	E: LON T F	FA: 1. I AVII	IL	s 1	O	TR	AN:	SF	ER	, OI	E	Ν,	INTE	RNAI				
CAUSE LO	SS	0	F M]	SS:	CON.																

ASSESSMEN ASSESSMEN NASA FME	NT NT A #	Di II ‡:	ATI	E:	3/ GN 05								SA BASI	ELI		[x]					
SUBSYSTEM MDAC ID: ITEM:					GN 15 AF	82 T PULSE & D RATE ROT PBI'S																	
LEAD ANAI	LYS	T	:		ĸ.	PI	ET:	Z															
ASSESSMEN	YT:	,																					
C	CRI			AL. GH'				RI	EDU	סאנ	AN	CY	S	CRE	EN	S					IL PEN		
	H				VC			A				В				С				1.	LEI	 	
NASA IOA	[3 2	/: /:	3]		[NA P	\]		[N P	A]		[NA P]]	X		*
COMPARE	[N	/1	1]		[N]		[N]		Į	N]			[N]	
RECOMMENI	IAC	'IC)NS	3:		(If	d:	iff	er	en	t	fr	om	NA	SA)							
	[2	/2	2]		[NA	\]		[N.	A]		[NA]		(AI				ETE)
* CIL RET	CEN	T1	[0]	1 I	TAS	IONZ	LI	E:	(1	f	ap	pl	ic	abl	•	AD VAD	EQU EQU	ATI	e E	[]	
REMARKS: IOA FAILU FMEA FAII PREMAUTRE IOA BELIE CAUSE LOS	LUR E O EVE	E PE S	MC ERA TH	DI LTI	e: Con P H	FA] AVIN	LS	I	O.	TR	AN	SF	ER	, 01	PEI	١,	INT	ERI	IAN				•

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	3/17/87 GNC-1585 05-1-FC72	61-0001	NASA DATA BASELINE NEW	
SUBSYSTEM: MDAC ID:	GNC 1585	PBI'S (FWD		
LEAD ANALYST:	K. PIETZ			
ASSESSMENT:				
CRITICAL: FLIGHT		REDUNDANCY SO	CREENS	CIL ITEM
	NC A	В	С	<u> </u>
NASA [3 /3 IOA [2 /2] []	NA] [NA] P] [P]	[NA] [P]	[x] *
COMPARE [N /N	j [1	и] [и]	[N]	[N]
RECOMMENDATIONS:	(If di	fferent from	NASA)	
[2 /2] [1	NA] [NA]		[A] ADD/DELETE
* CIL RETENTION	RATIONALE	: (If applic	able) ADEQUATE INADEQUATE	[]
REMARKS: IOA FAILURE MODE FMEA FAILURE MOD PREMATURE OPERAT IOA BELIEVES THA CAUSE LOSS OF MI	E: FAILS ION. T HAVING	TO TRANSFER	SSED POSITION. , OPEN, INTERN	AL SHORT,

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	3/17/87 GNC-158 05-1-FC	6 7260-00	01	NASA DATA BASELINE NEW	•
SUBSYSTEM: MDAC ID: ITEM:	GNC 1586 TRANSLA	TION PB	I'S (FWD	& AFT)	
LEAD ANALYST:	K. PIET	Z			
ASSESSMENT:					
CRITICAL: FLIGH	ITY r	REDUNDA	ANCY SCREI	ens	CIL
	NC	A	В	С	ITEM
NASA [3 /3 IOA [2 /2] [NA] P]	[NA] [P]	[NA] [P]	[x] *
COMPARE [N /N] [N J	[N]	[и]	[N]
RECOMMENDATIONS:	(If d	ifferent	from NAS	SA)	
[2 /2] [NA]	[NA]		[X] DD/DELETE)
* CIL RETENTION F	RATIONALI	E: (If a) ADEQUATE INADEQUATE	[]
REMARKS: IOA FAILURE MODE:	DRT C	MICK TH			. ,
PREMATURE OPERATI TRANSFER OUT OF I	ON, FAIL ON, FAII	S TO TRA	NSFER, OP ANSFER OU	EN, INTERNAL T OF LVLH, F	AILS TO
NASA FINDS ONLY "BELIEVES THAT HAV CAUSE LOSS OF MIS	ING ANY	POSITIO	ER OUT OF N PERMANE	LVLH" TO BE NTLY SELECTE	D COULD

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	3/17/87 GNC-1586 05-1-(TI	5 A 3D04)		NASA DATA: BASELINE NEW	
SUBSYSTEM:	GNC		S (FWD & A	AFT)	
LEAD ANALYST:	K. PIET	Z			
ASSESSMENT:					
CRITICAL: FLIGH		REDUNDANG	CY SCREENS	5	CIL ITEM
HDW/FUI		A	В	С	
NASA [3 /3 IOA [2 /2] [NA] [P] [NA] [P] [NA] P]	[
COMPARE [N /N] [и] [N] [иј	[N]
RECOMMENDATIONS:	(If d	ifferent :	from NASA))	
[2 /2] [NA] [NA] [NA]	[X] DD/DELETE)
* CIL RETENTION	RATIONALI	E: (If ap			_
			II	ADEQUATE NADEQUATE	[]
REMARKS: IOA FAILURE MODE FMEA FAILURE MODE TRANSFER OUT OF NASA FINDS ONLY BELIEVES THAT HA	E: SW MI LOW Z, PI "FAILS TO VING ANY	AN MODE LA REMATURE (D TRANSFEI POSITION	OW Z TRANS OPERATION, R OUT OF 1	SLATION: I , SHOCK. LVLH" TO BE	E 2/2. IO

ASSESSMENT DATE ASSESSMENT ID: NASA FMEA #:	: 3/17/87 GNC-158 05-1-(1	7 36B [BD05)	NASA DATA BASELINE NEW	
SUBSYSTEM: MDAC ID: ITEM:	GNC 1586	ATION PBI'S (FWD		
LEAD ANALYST:	K. PIET	rz		
ASSESSMENT:				
FLIG		REDUNDANCY SCRI	EENS C	CIL ITEM
		[NA] [NA] [P]	[NA] [P]	[] *
COMPARE [/] [[и] [и]	[N]	[]
RECOMMENDATIONS	: (If d	lifferent from NA	ASA)	
[/] [[] []	[] (A)	[] ADD/DELETE)
* CIL RETENTION	RATIONAL	E: (If applicab)		
			ADEQUATE INADEQUATE	
FMEA FAILURE MO LVLH MODE, PREM NASA FINDS ONLY	DE: SW, ATURE OPE "FAILS T AVING ANY	TUCK IN DEPRESSINAN MODE LVLH: RATION, SHORT. TO TRANSFER OUT OF POSITION PERMAN	ED POSITION. FAILS TO TRA	NSFER OUT OF

ASSESSMENT DATE ASSESSMENT ID: NASA FMEA #:	GNC-159		01	NASA DATA: BASELINE NEW]
SUBSYSTEM: MDAC ID: ITEM:	GNC 1590 FC ANNU	NCIATOR	CIRCUIT			
LEAD ANALYST:	K. PIET	Z				
ASSESSMENT:						
CRITICA		REDUNDA	ANCY SCRE	ENS	CIL ITEM	ſ
FLIC HDW/I		A	В	С		
NASA [3 /3 IOA [3 /3]	[NA] [NA]	[NA] [NA]	[NA] [NA]	[] *
COMPARE [/]	[]	[]	[]	[]
RECOMMENDATIONS	3: (If	differen	t from NA	SA)		
[/]	[]	[]	[] (A	[.DD/DI] ELETE)
* CIL RETENTION	N RATIONA	LE: (If	applicabl	e) ADEQUATE INADEQUATE]
REMARKS: IOA FAILURE MO "ALL CREDIBLE	DE "NO OU MODES".	TPUT" IS NO OTHER	INCLUDED DIFFEREN) IN NASA FAI ICES.	LURE	MODE

ASSESSMI ASSESSMI NASA FMI	ENT	I	D:	GN	/23/8 C-159 -60-2	1	DATA ELINI NEV	E [X]						
SUBSYSTI MDAC ID: ITEM:				GN 15 FC	_	NCIATO	OR C	IRCU	IT					
LEAD ANA	LYS	ST	:	ĸ.	PIET	Z								
ASSESSME	ENT:	:												
		F	ICAL LIGH	T			IDAN	CY S	CREEN	S		CI:		
	I.	1DV	/FU	NC		A		В		С				
NASA IOA]	3	/3 /3]		NA] NA]		NA] NA]	_	NA] NA]		[]	*
COMPARE	[/]	[1	[]	C	J		[)	
RECOMMEN	DAT	'IC	NS:	((If di	ffere	nt i	from	NASA)				
	[/]]]	[J	ι]	(A)	[DD/E		CTE)
* CIL RE	TEN	TI	ON 1	RATI	ONALE	: (If	apr	olica	able)			٠		•
REMARKS:									I	ADEQU.	ATE	[]	
IOA FAIL	URE L C	M RE	ODE DIBI	"IN LE M	ADVER	TENT NO	OUTF OTH	UT" ER I	IS IN	ICLUDE:	NI C	NAS	A F	AILURE

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	12/23/86 GNC-1593 05-60-20	5 3 00800-000	01	NASA DATA: BASELINE NEW	
MDAC ID:	GNC 1593 FC ANNUM	CIATOR (CIRCUIT		
LEAD ANALYST:	K. PIET	Z			
ASSESSMENT:					
CRITICAL: FLIGHT		REDUNDA	NCY SCREEN	S	CIL ITEM
HDW/FUI		A	В	С	
NASA [3 /3 IOA [3 /1R] [NA] P]	[NA] [[P] [NA] P]	[] *
COMPARE [/N] [N]	[и] [N]	[]
RECOMMENDATIONS:	(If d	ifferent	from NASA)	
[3 /1R] [P]	[P] [P] (A)	[] DD/DELETE)
* CIL RETENTION	RATIONAL	E: (If a	pplicable)		
			I	ADEQUATE NADEQUATE	
REMARKS: NASA DID NOT DIR FUNCTION OF ONE CRITICAL, BUT LO CREW/VEHICLE.	ACA (ANN	UNCIATOR	CONTROL A	SSEMBLY) W	OULD NOT BE

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	3/23/87 GNC-160 05-1-FC	1 7250-0001		NASA DATA BASELINE NEW		x]
	GNC 1601 ENTRY M	ODE SWITC	H CIRCUIT	•		
LEAD ANALYST:	J.M. HI	OTT				
ASSESSMENT:						
CRITICAL FLIGH HDW/FU	T	REDUNDAN A	CY SCREEN B	s c	CII	
NASA [3 /3 IOA [3 /3] [NA] [NA]	NA] [NA] NA]	[] *
COMPARE [/] [] [] []	[]
RECOMMENDATIONS:	(If d	ifferent	from NASA)		
[/] [] [] [•] DELETE)
* CIL RETENTION	RATIONAL	E: (If ap	plicable)	ADEQUATE	ſ	1
REMARKS:			I	NADEQUATE]
IOA FAILURE MODE ENERGIZED).						
FMEA FAILURE MODE SHORTED.	E: ALL C	REDIBLE M	ODES - FA	ILURE TO T	RANS	SFER,
NO ACTION REQUIR	ED - REST	ULTS ARE	THE SAME.			

		r DATE: 3/23/87 NASA DATE: 10: GNC-1602 BASELII #: 05-1-FC7250-0001 NI									[
SUBSYSTE MDAC ID:	M:			GN 16	C 02		DDE SW								
LEAD ANA	LYS	T:		J.	м. н	IIC	OTT								
ASSESSME	ENT:														
	CRITICALITY FLIGHT HDW/FUNC							DAN		CREENS			CII		
	H	IDW	/FU	INC			A		В		С				
NASA IOA]	3 3	/3 /3]		[NA] NA]	[NA] NA]] [NA] NA]		[]	*
COMPARE	[/	1		[]	[]	ſ]		[)	
RECOMMEN	IADI	ľIC	NS:		(If	đ:	iffere	nt :	from	NASA)	•				
	[/]		[]	[]	[]	(Al	[DD/I) DEL	ETE)
* CIL RE	ETEN	ITI	ON	RAI	ION	ALJ	E: (If	apı	plic	able)					
							•		-	II	ADEQUA NADEQUA	ATE ATE	[]	
REMARKS: IOA FAII FMEA FAI SHORTED. NO ACTIO	LURI	RE	MOI	E:	ALL	CI	REDIBL	E M			LURE '	ro T	RANS	FE:	R,

ASSESSME ASSESSME NASA FME															
SUBSYSTE MDAC ID: ITEM:	M:		GNC 1801 ABORT	MC	DDE	SWI	rc:	н (CIRCU	ΙΤ					
LEAD ANA	LYSI	:	J.M. H	IIC	TT										
ASSESSME	NT:														
	CRITICALITY FLIGHT HDW/FUNC NASA [3 /1R]							CY B	SCRE	ENS	s C		CIL		
NASA IOA	[3 [3	/1R /1R]	[[NA P]	[NA P	A]	[NA P	A]	[]	*
COMPARE	[/]	[N]	[N]	[N	1	[]	
RECOMMEN	DATI	ons:	(If	di	ff	erent	t :	fro	om NA	SA))				
	[/]	[]	[]	[[.DD/D:		TE)
* CIL RE	TENT	ION F	RATIONA	LE	:	(If a	p	pli	cabl	•		EQUATE EQUATE]	
IOA FAIL SWITCH CO TO GROUN	ONTA D.	CT FA	AILED O	PE	N (OR RE	ES]	[S]	OR A	1R1	AE L,	ORT MOD A1R2, A	E RO	FAR SHC	RY PRTEI

NO ACTION REQUIRED - RESULTS ARE THE SAME.

ASSESSME ASSESSME NASA FME	MASA FMEA #: 05-6-200400-1													ASA DATA BASELINE NEW	[]]		
SUBSYSTE MDAC ID:				18	01	MC	DDE	E SWI	rci	H (CIRC	UI	T						
LEAD ANA	LY	ST	:	J.	м. і	IIC)TI	נ										~	
ASSESSME	NT	:																	
	CR		ICAL:		•		RI	EDUND	AN	CY	SCR	EE	NS	3		CII			
	1			A B							С		111	31.1					
NASA IOA	[[3	/1R /1R]		[P P]	[NA P	\]		[P P]	[]	*
COMPARE	[/]		[]	ί	N]		[1	[]	
RECOMMEN	IDA'	ri	ons:		(If	đi	if1	feren	t :	fro	om N	AS	A)						
	[/]		[]	[]		[] (A	[DD/I			TE)
* CIL RE	TE	NT:	ION 1	RAT	ION	\LI	€:	(If	ap	pli	icab:	le	:)			_		_	
													IN	IA IAI	DEQUATE DEQUATE	[]	
REMARKS: IOA FAII SWITCH O TO GROUN FMEA FAI SHORTS, NO ACTIO	UR ON ID. LU CL	TA(RE OS)	MODIES,	AII E: Ina	ED (ALL DVEI	OPI CI RTI	en Rei Ent	OR R	ES: M(RA'	IST ODI TIC	ror i es - on.	A1	R .R1	A I	BORT MOD A1R2, A	E R0 1R3	OT S	AR	RTED

ASSESSMENT DATE: 1/23/87 ASSESSMENT ID: GNC-1802 NASA FMEA #: 05-6-2659-1													ASA D BASEL		[x]	
SUBSYSTE MDAC ID:				GNC 1802 ABORT	M	DDI	E SWIT	rci	H (CIRCU	ΊΤ							
LEAD ANA	ALYS	ST	:	J.M. I	HI	OT?	r							•				
ASSESSME	ENT:	:																
	CRI		ICALI LIGHT	LTY L		RI	EDUNDA	ANC	CY	SCRE	EN	S			C]	L LEN	vī	
	ŀ	IDV	/FUI	1C		A			В			С						
NASA IOA]	2	/1R /1R]	[P P]	[F P]	[F P]		[X X]	*
COMPARE	[/]	[]	[N]	[N]		[]	
RECOMMEN	[ADI	CIC	ons:	(If	đ:	if1	ferent	: 1	fro	om NA	SA)						
	[/]	[]	[]	[]	(AI		'DE		ETE)
* CIL RE	TEN	T	ON F	RATIONA	LI	3:	(If a	ıpţ	11	cabl	e)							
DEM DIG											I		DEQUA:		[]	
REMARKS: IOA FAII ROTARY S FMEA FAI CONDUCTS	URE WIT	CI E	I CON	TACT I	A?	LE ERT	ED CLC PENT C)SE)PE	ED. ERA	TION	· _	IN	IADVEI				101	Œ

NO ACTION REQUIRED - RESULTS ARE THE SAME.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/23/87 GNC-1802 05-6-200		NASA DATA: BASELINE NEW								
SUBSYSTEM: MDAC ID:	GNC 1802		CH CIRCUIT	יי							
LEAD ANALYST:	J.M. HIO	TT									
ASSESSMENT:											
CRITICAL: FLIGHT		REDUNDA	NCY SCREEN	is	CIL ITEM						
	_	A	С								
NASA [2 /1R IOA [2 /1R] [P] P]	[NA] [[P] [[F] [P]	[x] *						
COMPARE [/] [1	[и]	[и]	[N]						
RECOMMENDATIONS:	(If di	fferent	from NASA	A)							
[2 /1R] [NA]	[NA] ([X] DD/DELETE)						
* CIL RETENTION I	RATIONALE	: (If a			r 1						
DEWA DVC.			1	ADEQUATE NADEQUATE							
REMARKS: IOA FAILURE MODE				VITCH OR ABO	ORT MODE						
ROTARY SWITCH CONTACT FAILED CLOSED. FMEA FAILURE MODE: ALL CREDIBLE MODES - LOSS OF PWR, OPENS,											
CLOSES, INADVERTI			ITICALITY	TO 2/1R - A	ADD TO CIL.						

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/23/87 GNC-180 05-6-26	3 59-2	NASA DATA: BASELINE NEW	[X]							
SUBSYSTEM: MDAC ID: ITEM:	GNC 1803 ABORT M	ODE SWITCH	I CIRCUIT									
LEAD ANALYST:	J.M. HI	OTT										
ASSESSMENT:												
CRITICAL: FLIGH		REDUNDANC	Y SCREENS	3	CIL	-						
HDW/FU	_	A	В	С	ITEN	1						
NASA [3 /1R IOA [2 /1R] [NA] [P] [NA] [P] [NA] P]	[x] *						
COMPARE [N /] [и ј [и] [и ј	[N]						
RECOMMENDATIONS:	(If d	ifferent f	from NASA)									
[2 /1R] [P] [P] [[X D/DE] CLETE)						
* CIL RETENTION I	RATIONALI	E: (If app	•	ADEQUATE ADEQUATE	[]						
REMARKS: IOA FAILURE MODE: ROTARY SWITCH FAI ABORT.	: ABORT I	MODE PUSHE N IN THE P	SUTTON SWI	TCH FAILED	OPE R A	N OR SELECTED						
FMEA FAILURE MODIFAILS TO CONDUCT	OTARY SWITCH FAILED OPEN IN THE POSITION REQUIRED FOR A SELECTED BORT. MEA FAILURE MODE: PUSHBUTTON SWITCH OPENS - FAILS TO CLOSE, AILS TO CONDUCT (MULTI-CONTACTS). CTION REQUIRED - UPDATE FMEA CRITICALITY - ADD TO CIL.											

ASSESSMENT DAT ASSESSMENT ID: NASA FMEA #:	E: 1/23/8' GNC-18 05-6-2	7 03A 00400-1		NASA DATA: BASELINE NEW	
SUBSYSTEM: MDAC ID: ITEM:	GNC 1803 ABORT	MODE SWIT	CH CIRCUI	т	
LEAD ANALYST:	J.M. H	IOTT		t	
ASSESSMENT:					
	ALITY GHT	REDUNDA			CIL ITEM
HDW,	FUNC		_	С	
NASA [3 /	'1R] '1R]	[P] [P]	[NA] [P]	[P] [P]	[x] *
COMPARE [N ,	']	[]	[N]	[]	[N]
RECOMMENDATIO	vs: (If	different	from NAS	5A)	
[2,	/1R]	[P]	[P]	[P]	[X] ADD/DELETE)
* CIL RETENTI	ON RATIONA	ALE: (If a	applicable	e) ADEQUATE INADEQUATE	
REMARKS: IOA FAILURE M ROTARY SWITCH FMEA FAILURE CLOSES, INADV ACTION REQUIR	FAILED OF MODE: ALL	PEN IN THE CREDIBLE	MODES -	LOSS OF PWR,	OPENS,

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	1/23/87 GNC-180 05-6-26		NASA DATA BASELINE NEW		
SUBSYSTEM:	GNC 1804		CH CIRCUIT	ı	
LEAD ANALYST:	J.M. HI	OTT			
ASSESSMENT:					
CRITICAL FLIGH	ITY T	REDUNDAN	ICY SCREEN	S	CIL ITEM
HDW/FU	NC	A	В	С	TIEM
NASA [2 /1R IOA [1 /1] [P] [F] [P] [F] F]	[X] * [X]
COMPARE [N /N] [] [и ј []	[]
RECOMMENDATIONS:	(If d	ifferent	from NASA))	
			NA] [[X] DD/DELETE)
* CIL RETENTION F	RATIONALE	: (If ap	plicable)		
REMARKS:				ADEQUATE ADEQUATE	į į
IOA FAILURE MODE: SWITCH FAILED CLO MODE.	ABORT M SED IN A	ODE PUSHI POSITION	BUTTON FAI N OTHER TH	LED CLOSED AN THE REQ	OR ROTARY UIRED ABORT
FMEA FAILURE MODE INADVERTENTLY CON ACTION REQUIRED -	DUCTS, I	NTERNALL	/ FATTED C	TACED AMIT	TIPOLES).

ASSESSMENT DATE: 1/23/87 ASSESSMENT ID: GNC-1804A NASA FMEA #: 05-6-200400-1											ASA DATA BASELINE NEW	[
SUBSYSTIMDAC ID:	:			18	304	MC	DDE	SWI	rci	H C	CIRCU	ĽΫ́						
LEAD AN	ALYS	ST	:	J.	.M. F	IIC	ľľ	?										
ASSESSMI	ENT	:																
	CR						RE	DUND	ANO	CY	SCRE	ENS	3		C]	L EN		
	FLIGHT HDW/FUNC						A			В			С				•	
NASA IOA	[3 1	/1R /1]		[P P]	[NA P	\]	[P F]	[x]	*
COMPARE	[N	/N]		[]	[N]	[N]	[N]	
RECOMME	NDA!	ΓI	ons:		(If	đ	Ĺfſ	eren	t :	fro	om NAS	SA))					
	[/]		[]	[]	[] (A] ELE	ETE)
* CIL R	ETE	NT:	ION	RA!	rion?	\LI	Ξ:	(If	įqe	pli	icable			DEQUATE DEQUATE	[]	
SWITCH I	LURI FAI:	LE	D CI	OS)	ED IN	1 2	A I	POSIT	[O]	N C	THER	TI	IAH	ED CLOSE N THE RE	QU:	ERI	ΞD	
SHORTS,	CL	os:	ES,	IN	ADVE	RTI	ENT	OPE	RA'	ric	ON.			-1802A,				BA.

ASSESSME ASSESSME NASA FME	NT	I		GN	C-19		L						1		DATA: LINE NEW	[]
SUBSYSTE MDAC ID:				GN 19 AT		F	PE	3									
LEAD ANA	LY:	ST	:	TR	AHAN	,	W.	н.									
ASSESSME	NT	:															
		F	ICAL: LIGH:	ר			RI A	EDUN	DAN	CY B	s	CREEN	is (•		CIL	M
		יענו	M/ I UI	10			A			D			•	•			
NASA IOA	[3	/ /1R]]	P]	[P]	[]	I)		[] *
COMPARE	[N	/N]		[N]	(N]	[·	ן ז		[]
RECOMMEN	DA!	ric	ONS:		(If	d:	lff	ere	nt	fr	om	NASA	١)				
	[3	/1R]		[P]	[P)	[F)		[DD/DI] ELETE)
* CIL RE	TEI	NT:	ON E	RAT	IONA	L	C:	(If	ap	pl:	ica	•	P		ATE ATE	[]
TOA FATT	ITRI	7 N	MODE 4		TRATI	T٩	ם ק	TT A	ΛP	FN							

IOA FAILURE MODE: CIRCUIT FAIL OPEN.
IOA DOES RECOMMEND A FMEA FOR THIS FAILURE MODE SINCE THE CRITICALITY IS 3/1R AND PASSES ALL SCREENS. THE OTHER PUSHBUTTON IS AVAILABLE.

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:		!		NASA DATA BASELINE NEW]
MDAC ID:	GNC 1902 ATT REF	PB				
LEAD ANALYST:	TRAHAN,	w. H.				
ASSESSMENT:						
CRITICAL	-	REDUN	DANCY SCRE	EENS	CIL	
FLIGH HDW/FU		A	В	С		••
NASA [/ IOA [3 /1R] [P]	[] [P]	[] [P]	[] *
COMPARE [N /N] [и]	[אַ]	[N]	[]
RECOMMENDATIONS:	(If d	iffere	nt from NA	ASA)		
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* CIL RETENTION	RATIONAL	E: (If	applicabl	le) ADEQUATE INADEQUATE	[]
REMARKS: IOA FAILURE MODE IOA DOES RECOMME CRITICALITY IS 3	ND A FME	A FOR	THIS FAIL	URE MODE SINC	E TH	

ASSESSMENT DAT ASSESSMENT ID: NASA FMEA #:	GNC-195		REF NO.	NASA DATA BASELINI NEV								
SUBSYSTEM: MDAC ID: ITEM:	1950	MENT IS	OLATION R	ESISTORS								
LEAD ANALYST:	LES DRA	PELA										
ASSESSMENT:												
CRITIC	ALITY GHT	REDUNDA	ANCY SCRE	ENS	CIL							
		A	В	С	ITEM							
NASA [3 / IOA [3 /	3] [NA] NA]	[NA] [NA]	[NA] [NA]	[] *							
COMPARE [/] []	[]	[]	[]							
RECOMMENDATION	s: (If di	fferent	from NA	SA)								
[/] []	[]		[] DD/DELETE)							
* CIL RETENTIO	N RATIONALE	: (If a	pplicable	•								
REMARKS:				ADEQUATE INADEQUATE	[]							
IOA FAILURE MO	REMARKS: IOA FAILURE MODE: OPENS, OUT OF TOLERANCE, SHORTS. FMEA FAILURE MODE: ACCELEROMETER ASSEMBLY MEASUREMENT ISOLATION RESISTORS-OPENS, OUT OF TOLERANCE, SHORTED TO GROUND.											

ASSESSM ASSESSM NASA FM	CMIN	TI	٠.	GN	C-10	F 1	Y		EL	RE	EF	NO.		NASA DA BASELI N	NE	ſ]	
SUBSYST MDAC ID ITEM:				GN 19 ME	51	ŒM	ŒNT	r Iso) L.F	\T]	ON	RE	SI	STORS				
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ASSESSM	ENT	:																
		F	LIGH	ΙΤ				DUND	ANC	CY	sc	REE	NS			CIL ITEN	1	
		HD	W/FU	INC			A			В				С				
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* CIL I	≀ETE	ENT	ION	RAT	NOI	ΑL	E:	(If	ap)	pl.	ica			ADEQUA!	re re	[]	
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SUBSYSTI MDAC ID: ITEM:	:			195	2	MENT	ISOL	ATION	RES	ISTORS			
LEAD ANA	YLY	ST	:	LES	DRA	PELA							
ASSESSME	ENT	:											
		F	LIGH	łT							CII		
		HD	W/Ft	JNC		A		В		С			
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COMPARE	[/]	[]	ι]	Į	1	[]	
RECOMMEN	DA'	ri(ONS:	(1	[f di	iffer	ent i	from N	IASA)				
	[/	J	[]	[]	ι] (A	/DD/E] ELET	ĽE)
* CIL RE	TE	NT:	ION	RATIO	NALE	E: (I	f app	olicab					
DEMADECA									IN	ADEQUATE ADEQUATE	[[]]	
NO DIFFE CIRCUIT OPERATIO	URI LUI OLI REI OPI N.	RE ERA NCE ERA	MOD ANCE ES: ATIO	E: AS , SHC THE I N, AN	RTED NSTR	ASURI LUMENT T RE(EMENT TATIC QUIRE	I ISOL ON DAT ID FOR	ATIO A IS VEH	N RESISTO USED TO ICLE CONT	MONI ROL	TOR OR	
MEASUREM	W(DRI	SHE	ATION ET (M	KES	TSTO	RS IN	MONT	TORT	OCUMENT T NG CIRCUI DED. IOA	ጥሮ	7A 1AT	TOTAL

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	•		NASA DATA BASELINE NEW	
SUBSYSTEM: MDAC ID: ITEM:	GNC 1953 MEASUREME	ENT ISOLATION R	ESISTORS	
LEAD ANALYST:	LES DRAPE	ELA		
ASSESSMENT:				•
FLIGH		REDUNDANCY SCRE	ENS C	CIL ITEM
		NA] [NA] NA] [NA]	[NA] [NA]	[] *
COMPARE [/] [] []	[]	[]
RECOMMENDATIONS:	(If dif	fferent from NA	SA)	
[/] [] []		[] DD/DELETE)
* CIL RETENTION	RATIONALE:	: (If applicabl	e) ADEQUATE INADEQUATE	[]
REMARKS: IOA FAILURE MODE FMEA FAILURE MOD OPEN, OUT-OF-TOL NO DIFFERENCES: CIRCUIT OPERATIO OPERATION. DURING THE ORIGI MEASUREMENT ISOL ANALYSIS WORKSHE WITH THE NEW FME	E: ATVC ME ERANCE, SH THE INSTRU N, AND NOT NAL ANALYS ATION RESI ET (MDAC I	EASUREMENT ISOLHORTED. JMENTATION DATA REQUIRED FOR SIS, IOA DID NO ISTORS IN MONIT	E, SHORTS. ATION RESISTO IS USED TO DEVELOE CONTO T DOCUMENT TOORING CIRCUIT	ORS FAIL MONITOR ROL OR HE FAILURE OF IS. A NEW

ASSESSMENT DATE: ASSESSMENT ID: NASA FMEA #:	3/20/87 GNC-1954X 05-60-IMU(05))	NASA DATA BASELINE NEV	
MDAC ID:	GNC 1954 MEASUREMENT	ISOLATION F	ESISTORS	
LEAD ANALYST:	LES DRAPELA			
ASSESSMENT:				
FLIG		NDANCY SCRE	ENS	CIL ITEM
HDW/FU	INC A	В	С	
NASA [3 /3 IOA [3 /3] [NA]] [NA]	[NA] [NA]	[NA] [NA]	[] *
COMPARE [/] []	[]	[]	[]
RECOMMENDATIONS:	(If differe	ent from NA	SA)	
[/] []	[]		[] ADD/DELETE
* CIL RETENTION	RATIONALE: (If	f applicabl	ADEOUATE	[]
REMARKS:			INADEQUATE	
IOA FAILURE MODE FMEA FAILURE MODE NO ACTION REQUIRE	E: IMU (15 RES	SISTORS) OP	ENS, OUT OF	OLERANCE. TOLERANCE

APPENDIX D

CRITICAL ITEMS

APPENDIX D

CRITICAL ITEMS

NASA FMEA	IOA ID	ITEM NAME	FAILURE MODE
05-1-FC3042-1	101	RHC	PHY JAMMING/BINDING
05-1-FC3142-1	202	THC	IMMOBLE (JAM/BIND)
05-1-FC3442-3	304	RPTA	LOSS OF ONE RPTA
05-1-FC3242-1 05-1-FC3242-4	401 406	SBTC SBTC	PHY JAMMING/BINDING SW CONTACT FAIL CLOSE
05-1-GN21-2 05-60-200200-2 05-1-GN21-1 05-60-200201-1	501 501 502 510	IMU IMU IMU IMU DIODE	ERRONEOUS OUTPUT ERRONEOUS OUTPUT NO OUTPUT FAILED OPEN
05-1-FC1042-2 05-60-200301-1,-2 05-1 - SRB -2 05-60-GN0804-1,-2 05-60-FC1042-1	902 904 951 960 906	RGA (ORB) RGA (ORB) DIODE RGA (SRB) RGA (SRB) DIODE RGA (ORB) RPC	ERRONEOUS OUTPUT FAILED OPEN ERRONEOUS OUTPUT FAILED OPEN FAILED OPEN
05-1-FC2042-2 05-60-200501-1,-2	1002 1014	AA AA DIODE	ERRONEOUS OUTPUT FAILED OPEN
05-1-FC6042-1 05-60-200700-1 05-60-200701-1,-2 05-60-200708-1 05-60-200709-1	1103 1130 1130 1130 1130	ASA ASA PWR CKT " " " " " "	NULL OUTPUT FAILED OPEN """ """"
05-1-FC6242-1 05-1-FC6342-2 05-1-FC6242-2	1201 1205 1206	RJDF RJDA RJDF	NO OUTPUT TO JET INADVERT JET FIRING INADVERT JET FIRING
05-1-FC6542-1 05-60-200600-1 05-60-200601-1,-2 05-60-200602-1 05-60-200606-1	1303 1310 1310 1310 1310	ATVC ATVC PWR CKT " " " " " "	NULL OUTPUT FAILED OPEN " " " "
05-1-FC7258-2 05-1-FC7259-2	1576 1580	ORB DAP MAN PB ORB DAP NOR/VER PB	FAILED CLOSED FAILED CLOSED

APPENDIX E DETAILED ANALYSIS

This appendix contains the IOA analysis worksheets supplementing previous results reported in STSEOS Working Paper 1.0-WP-VA86001-16, Analysis of the Guidance, Navigation, and Control Subsystem FMEA/CIL (16 December 1986). Prior results were obtained independently and documented before starting the FMEA/CIL assessment activity. Supplemental analysis was performed to address failure modes not previously considered by the IOA. Each sheet identifies the hardware item being analyzed, parent assembly and function performed. For each failure mode possible causes are identified, and hardware and functional criticality for each mission phase are determined as described in NSTS 22206, Instructions for Preparation of FMEA and CIL, 10 October 1986. Failure mode effects are described at the bottom of each sheet and worst case criticality is identified at the top.

LEGEND FOR IOA ANALYSIS WORKSHEETS

Hardware Criticalities:

- 1 = Loss of life or vehicle
- 2 = Loss of mission or next failure of any redundant item
 (like or unlike) could cause loss of life/vehicle
- 3 = All others

Functional Criticalities:

- 1R = Redundant hardware items (like or unlike) all of which,
 if failed, could cause loss of life or vehicle.
- 2R = Redundant hardware items (like or unlike) all of which, if failed, could cause loss of mission.

Redundancy Screen A:

- 1 = Is Checked Out PreFlight
- 2 = Is Capable of Check Out Preflight
- 3 = Not Capable of Check Out PreFlight
- NA = Not Applicable

Redundancy Screens B and C:

- P = Passed Screen
- F = Failed Screen
- NA = Not Applicable

DATE: 1/09/87 HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: GNC FLIGHT: 2/1R MDAC ID: 406 ABORT: 1/1

ITEM: SBTC

FAILURE MODE: PHYSICAL JAMMING OF TAKEOVER SWITCH

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:

- 1) GNC
- 2) SBTC
- 3)
- 4)
- 5)
- 6)
- 7)
- 8) 9)

CRITICALITIES

HDW/FUNC	ABORT	HDW/FUNC
3/3	RTLS:	2/1R
2/1R	TAL:	1/1
3/3	AOA:	2/1R
3/1R	ATO:	2/1R
3/1R		,
	3/3 2/1R 3/3 3/1R	3/3 RTLS: 2/1R TAL: 3/3 AOA: 3/1R ATO:

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION: PNL L2 (31V73A2A2), C3 (35V73A3A3)

PART NUMBER: MC621-0043-3240

CAUSES: VIBRATION, MECHANICAL SHOCK, CONTAMINATION, MISHANDLING, PIECE PART STRUCTURAL FAILURE.

EFFECTS/RATIONALE:

FOR PLT MAN THRUST TAKEOVER, 1ST FAILURE IS THE NEED FOR DOWNMODE FROM AUTO TO MANUAL. DURING ASCENT, THE PLTS TAKEOVER SWITCH JAMMED ON OR OFF WILL RESULT IN EITHER MANUAL OR AUTO THRUST CAPABILITY. TAL ABORT REQUIRES MANUAL THRUST CAPABILITY. BOTH CDRS AND PLTS SBTC CONTROLS SPD BRK CMDS DURING ENTRY. IF ONE TAKEOVER SWITCH JAMS OPEN, OTHER POSITION PERFORMS FUNCTION. IF TAKEOVER SWITCH JAMS ON, ONLY MANUAL CONTROL OF SPD BRK EXISTS. SPD BRK IS NORMALLY FLOWN IN AUTO DURING ENTRY.

1/09/87

HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: GNC

FLIGHT: 3/1R ABORT: 3/3

MDAC ID: 603

ITEM: STAR TRACKER

FAILURE MODE: LOSS OF INPUT

LEAD ANALYST: LES DRAPELA SUBSYS LEAD: LES DRAPELA

BREAKDOWN HIERARCHY:

- 1) GNC
- 2) STAR TRACKER
- 3)
- 4)
- 5)
- 6)
- 7) 8)
- 9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/1R	AOA:	3/3
DEORBIT:	3/3	ATO:	3/3
LANDING/SAFING:	3/3		

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION: 10V71A7(-Y), A6(-Z)

PART NUMBER: MC431-0128-0012

CAUSES: INPUT CIRCUITRY FAILED DUE TO MECHANICAL SHOCK,

VIBRATION, TEMPERATURE

EFFECTS/RATIONALE:

CREW CANNOT ISSUE COMMANDS - THE OTHER ST AND COAS SERVE AS

BACKUP.

DATE:

1/09/87

HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: GNC

FLIGHT: 3/1R

MDAC ID:

604

ABORT:

3/3

ITEM:

STAR TRACKER

FAILURE MODE: MECHANICAL SHUTTER FAILS OPEN

LEAD ANALYST: LES DRAPELA SUBSYS LEAD: LES DRAPELA

BREAKDOWN HIERARCHY:

- 1) GNC
- 2) STAR TRACKER
- 3)
- 4)
- 5)
- 6)
- 7)
- 8) 9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/1R	AOA:	3/3
DEORBIT:	3/3	ATO:	3/3
LANDING/SAFING:	3/3		•

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION: 10V71A7(-Y), A6(-Z)

CAUSES: VIBRATION, JAMMING, MECHANICAL SHOCK

PART NUMBER: MC431-0128-0012

EFFECTS/RATIONALE:

POSSIBLE LOSS OF THE ST DUE TO SUN DAMAGE. THE OTHER ST AND COAS

SERVE AS BACKUP.

DATE: 1/07/87 HIGHEST CRITICALITY HDW/FUNC SUBSYSTEM: GNC FLIGHT: 3/1R MDAC ID: 703 ABORT: 3/3

ITEM:

COAS

FAILURE MODE: INCORRECT MOUNTING OR UNABLE TO MOUNT

LEAD ANALYST: LES DRAPELA SUBSYS LEAD: LES DRAPELA

BREAKDOWN HIERARCHY:

- 1) GNC
- 2) COAS
- 3)
- 4)
- 5)
- 6)
- 7)
- 8) 9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/1R	AOA:	3/3
DEORBIT:	3/3	ATO:	3/3
LANDING/SAFING:	3/3		•

REDUNDANCY SCREENS: A [2] B [P] C [P]

LOCATION:

PANEL 01 (CMD'S STATION), OVERHEAD WINDOW W7 (AFT

STATION)

PART NUMBER: V620-660-810

CAUSES: VIBRATION, SHOCK

EFFECTS/RATIONALE:

LOSS OF COAS - 2 ST'S AVAILABLE

DATE: 3/25/87 HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: GNC FLIGHT: 3/1R ABORT: 3/1R MDAC ID: 1014

ITEM: DIODE - AA'S 3 & 4 POWER CIRCUITS

FAILURE MODE: FAILS OPEN

LEAD ANALYST: LES DRAPELA SUBSYS LEAD: LES DRAPELA

BREAKDOWN HIERARCHY:

- 1) GNC
- 2) ACCELEROMETER ASSEMBLY
- 3) AA'S 3 & 4 POWER CIRCUIT
- 4) DIODE
- 5)
- 6)
- 7)
- 8)
- 9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/1R
LIFTOFF:	3/1R	TAL:	3/1R
ONORBIT:	3/3	AOA:	3/1R
DEORBIT:	3/1R	ATO:	3/1R
LANDING/SAFING	: 3/1R		•

REDUNDANCY SCREENS: A [2] B [F] C [P]

LOCATION: 83V76A24

PART NUMBER: JANTXIN1204RA

CAUSES: SHORT TO GROUND, PIECE PART STRUCTURAL FAILURE,

VIBRATION

EFFECTS/RATIONALE:

AA'S 3 & 4 HAVE TWO POWER CIRCUITS. THE LOSS OF ONE DIODE REMOVES ONE POWER CIRCUIT ONLY, THE OTHER CIRCUIT CONTINUES TO SUPPLY POWER TO THE RGA. THE LOSS OF ONE DIODE CANNOT BE DETECTED, THEREFORE SCREEN B IS FAILED.

HIGHEST CRITICALITY HDW/FUNC 3/03/87 DATE: FLIGHT: 3/3 SUBSYSTEM: GNC

ABORT: 3/3 MDAC ID: 1950

MEASUREMENT ISOLATION RESISTORS ITEM: FAILURE MODE: OPENS, OUT OF TOLERANCE, SHORTS

LEAD ANALYST: LES DRAPELA SUBSYS LEAD: LES DRAPELA

BREAKDOWN HIERARCHY:

- 1) GNC
- 2)
- 3)
- 4)
- 5)
- 6)
- 7) 8)
- 9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/3	AOA:	3/3
DEORBIT:	3/3	ATO:	3/3
LANDING/SAFING:	: 3/3		-

REDUNDANCY SCREENS: A [NA] B [NA] C [NA]

LOCATION: THROUGHOUT GNC SUBSYSTEM

PART NUMBER:

CAUSES: SHOCK, VIBRATION, TEMPERATURE

EFFECTS/RATIONALE:

NONE. ONLY USED TO MONITOR CIRCUITS, NOT REQUIRED FOR VEHICLE OPERATION.

DATE: HIGHEST CRITICALITY HDW/FUNC 3/03/87

SUBSYSTEM: GNC FLIGHT: 3/3 MDAC ID: 1951 ABORT: 3/3

MEASUREMENT ISOLATION RESISTORS ITEM: FAILURE MODE: OPENS, OUT OF TOLERANCE, SHORTS

LEAD ANALYST: LES DRAPELA SUBSYS LEAD: LES DRAPELA

BREAKDOWN HIERARCHY:

- 1) GNC
- 2)
- 3)
- 4)
- 5)
- 6)
- 7)
- 8) 9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/3	AOA:	3/3
DEORBIT:	3/3	ATO:	3/3
LANDING/SAFING:	3/3		

REDUNDANCY SCREENS: A [NA] B [NA] C [NA]

LOCATION: THROUGHOUT GNC SUBSYSTEM

PART NUMBER:

CAUSES: SHOCK, VIBRATION, TEMPERATURE

EFFECTS/RATIONALE:

NONE. ONLY USED TO MONITOR CIRCUITS, NOT REQUIRED FOR VEHICLE

OPERATION.

HIGHEST CRITICALITY HDW/FUNC DATE: 3/03/87 FLIGHT: 3/3 SUBSYSTEM: GNC 3/3 ABORT: MDAC ID: 1952

ITEM: MEASUREMENT ISOLATION RESISTORS FAILURE MODE: OPENS, OUT OF TOLERANCE, SHORTS

LEAD ANALYST: LES DRAPELA SUBSYS LEAD: LES DRAPELA

BREAKDOWN HIERARCHY:

- 1) GNC
- 2)
- 3)
- 4)
- 5)
- 6) 7)
- 8) 9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/3	AOA:	3/3
DEORBIT:	3/3	ATO:	3/3
LANDING/SAFING:	3/3		

REDUNDANCY SCREENS: A [NA] B [NA] C [NA]

LOCATION: THROUGHOUT GNC SUBSYSTEM

PART NUMBER:

CAUSES: SHOCK, VIBRATION, TEMPERATURE

EFFECTS/RATIONALE:

NONE. ONLY USED TO MONITOR CIRCUITS, NOT REQUIRED FOR VEHICLE OPERATION.

DATE: 3/03/87 HIGHEST CRITICALITY HDW/FUNC DATE: 3/ SUBSYSTEM: GNC

FLIGHT: 3/3 ABORT: 3/3 MDAC ID: 1953

MEASUREMENT ISOLATION RESISTORS ITEM: FAILURE MODE: OPENS, OUT OF TOLERANCE, SHORTS

LEAD ANALYST: LES DRAPELA SUBSYS LEAD: LES DRAPELA

BREAKDOWN HIERARCHY:

- 1) GNC
- 2)
- 3)
- 4)
- 5)
- 6) 7)
- 8)
- 9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/3	AOA:	3/3
DEORBIT:	3/3	ATO:	3/3
LANDING/SAFING	: 3/3		•

REDUNDANCY SCREENS: A [NA] B [NA] C [NA]

LOCATION: THROUGHOUT GNC SUBSYSTEM

PART NUMBER:

CAUSES: SHOCK, VIBRATION, TEMPERATURE

EFFECTS/RATIONALE:

NONE. ONLY USED TO MONITOR CIRCUITS, NOT REQUIRED FOR VEHICLE

OPERATION.

HIGHEST CRITICALITY HDW/FUNC 3/03/87 DATE: FLIGHT: 3/3 ABORT: 3/3 SUBSYSTEM: GNC

MDAC ID: 1954

ITEM: MEASUREMENT ISOLATION RESISTORS FAILURE MODE: OPENS, OUT OF TOLERANCE, SHORTS

LEAD ANALYST: LES DRAPELA SUBSYS LEAD: LES DRAPELA

BREAKDOWN HIERARCHY:

- 1) GNC
- 2)
- 3)
- 4)
- 5)
- 6) 7)
- 8)
- 9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/3	AOA:	3/3
DEORBIT:	3/3	ATO:	3/3
LANDING/SAFING	: 3/3		

REDUNDANCY SCREENS: A [NA] B [NA] C [NA]

LOCATION: THROUGHOUT GNC SUBSYSTEM PART NUMBER:

CAUSES: SHOCK, VIBRATION, TEMPERATURE

EFFECTS/RATIONALE:

NONE. ONLY USED TO MONITOR CIRCUITS, NOT REQUIRED FOR VEHICLE OPERATION.

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APPENDIX F

NASA FMEA TO IOA WORKSHEET CROSS REFERENCE/RECOMMENDATIONS

This section provides a cross reference between the NASA FMEA and corresponding IOA analysis worksheet(s) included in Appendix E. The Appendix F identifies: NASA FMEA Number, IOA Assessment Number, NASA criticality and redundancy screen data, and IOA recommendations.

Appendix F Legend

Code Definition

None.

APPENDIX F

NASA FMEA TO IOA WORKSHEET CROSS REFERENCE / RECOMMENDATIONS

: IDENTIFIERS :			IASA	IDA RECOMMENDATIONS \$							
: NASA : FREA NUMBER	: IDA :: : ASSESSMENT NUMBER :			: : CRIT : HW/F	SCREENS	OTHER (SEE LEGEND CODE)	: ISSUE				
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05-01-(10), PREL REF 05-1-(09), PREL REF		1 2/18		1 /							
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		3/2R	! P P P !	1 /							
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			: NA NA NA :		;						
05-1-(TBD06)	: GNC-1541B :		! NA NA NA !		IPPP:	<u>.</u>					
		1 2/2	! NA NA NA !	1 /	1						
05-1-FC1042-1	GNC-901			[/	;	;					
05-1-FC1042-2	6NC-902			i /							
05-1-FC2042-1	BNC-1001			1 /	!	;					
05-1-FC2042-2	: GNC-1002 :			1 /	1						
05-1-FC3042-1	GNC-101 !		i na na na i	/	;						
05-1-FC3042-2	GNC-102			1 /	1						
. AF 1 FREALS T	GNC-104 /		PPP		!	J ì					
05-1-FE3042-3	GNC-103		IPPP !		1						
	GNC-105	1 3/18	! P P P !		1 !						
05-1-FC3142-1	GNC-202 :		IPPP :	1 /	1						
	GNC-201 (!	;					
05-1-FC3142-3	BNC-203		PPP;	1 /	1						
	GNC-401	: 2/1R	1 P P P 1	1 /	1 1	<u> </u>					
	: ENC-402	1 3/1R	IPPP:	1 /	1						
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05-1-FC3442-3	GNC-304	1/1] NA NA NA (1 /	1	1					
05-1-FC6042-1	GNC-1103 :	2/1R	! P F P !	1 /	1 1) 					
05-1-FC4042-2	GNC-1104 ;	3/1R	;	1 /	1 1	!					
05-1-FC62 42-1	ENC-1201 :	2/1R	! P P P	1 /	1	<i>i</i>					
	GNC-1206	1/1	: P	1 /	1 1						
05-1-FC6342-1	BNC-1203 (PPP;	1 /	i ;	;					
05-1-FC6342-2	GNC-1205	1/1	IPPP !	1	: :	İ					
05-1-F06542-1	GNC-1303 :	2/1R	! P F P	I = I	1 1	!					
05-1-FC6542-2	GNC-1304 (3/1R	PPP:	1	:	!					
	GNC-120 !	3/3	NA NA NA I	1 /	! !	[
;	GNC-121 {	3/3	NA NA NA I	1 /	[]	:					
05-1-FC7242-0001	GNC-140 }	3/3	: NA NA NA :	1	1	#					
!	GNC-141 :	3/3	NA NA NA I	1	1 1	i i					
05-1-FC7244-0001	SMC-1110	3/1R	IFPP:	3/1R	F P P I						
! !	GNC-1111 !	3/1R	F P P I			!					
05-1-FC7244-0002	GNC-1111A :		FPP!								
05-1-FC7245-0001	GNC-160	3/3	NA NA NA I		NA NA NA I	!					
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105-1-FC7245-0001	FMEA NUMBER						C	H#/	F	A	B	C		
OS-1-FC7245-0001 SNC-1600 1 3/3 NA 1A AA 1 3/1R P P P		•	•					•		•	=== P	===: Ρ	======================================	
05-1-FC7246-0001											p	Ρ :	 	
		: GNC-150A	1 3/3	;	NA	NA I	NA :	; 3/	18	P	P	P		
OS-1-FC7248-0001		! GNC-151A	1 3/3	;	NA	NA I	NA I	1 3/	18	۱ ۴	7	ρ		
OS-1-FC7249-0002	05-1-FC7246-0002	BNC-160E	1 3/3	† 1	NA	NA	NA 3	: 3/	18	P	P	p	;	
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SHC-161C	05-1-FC7248-0002				NA	NA I	NA :				P	P	!	
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OS-1-FC7251-0001										í				
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		6NC-131A	1 3/3	1	NΑ	AK	NA I	;	i	ř L			1	
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